Optic pathway hypothalamic pilocytic astrocytoma

Most individuals with optic pathway/hypothalamic pilocytic astrocytoma (OPHPA) harbor either the BRAF V600E mutation or KIAA1549-BRAF fusion (K-B).

However, there have been suggestions that gliomas in the optic nerve, and especially pilocytic astrocytoma of the optic nerve, are biologically different from tumors within the hypothalamus and other parts of the optic tract. Furthermore, the recent discovery of BRAF duplication and fusion with the KIAA1549 gene is reported to be more typical for posterior fossa tumors, and the rate of this aberration is not well known in pilocytic astrocytoma of the optic nerve. To determine the distinction of pilocytic astrocytoma of the optic nerve from pilocytic astrocytoma of the posterior fossa and to investigate the prevalence of BRAF aberrations, Reis et al., reviewed the clinicopathological and molecular features of all such patients in our institution.

The study demonstrates that BRAF duplication is more frequent in posterior fossa tumors compared with pilocytic astrocytoma of the optic nerve (P=0.011). However, the rates of phospho-MAPK1 and CDKN2A expression were high in both pilocytic astrocytoma of the optic nerve and posterior fossa pilocytic astrocytoma, suggesting that the MAPK pathway is active in these tumors. Our study supports the notion that BRAF duplication is more typical of posterior fossa pilocytic astrocytoma and that molecular alterations other than KIAA1549 fusion may underlie MAPK pathway activation in pilocytic astrocytoma of the optic nerve [1)].

Outcome

The spontaneous regression that occurs after partial/subtotal resection is multifactorial, depending on multiple factors, as for the case of humoral and cell-mediated immune responses of the host to the implanted tumor.

Case series

Seven cases of OPHPA harboring either the BRAF V600E mutation or K-B fusion were included in a study. Preoperative magnetic resonance imaging (MRI) was assessed for degree of T2 hyperintensity on T2-weighted images (T2WI) and the ratio of nonenhancing T2 or fluid-attenuated inversion recovery (FLAIR) hyperintense area to the contrast enhanced area (CE) on gadolinium-enhanced-T1 weighted images (T2/FLAIR-CE mismatch). The T2 signal intensity was normalized to cerebrospinal fluid (T2/CSF) for both the V600E and K-B group and compared. T2/FLAIR-CE mismatch was assessed by calculating the proportion of the tumor volume of nonenhancing high T2 signal intensity to the whole lesion (nonenhancing and enhancing components).

Four and three cases of OPHPA harboring the BRAF V600E mutation and K-B, respectively, were analyzed. The T2/CSF value was higher in the K-B group than in the V600E group. Moreover, the V600E group had a larger T2/FLAIR-CE mismatch than the K-B group.

The BRAF alteration status in individuals with OPHPA was associated with preoperative MRI by

focusing on T2 signal intensity and T2/FLAIR-CE mismatch. The BRAF V600E mutation was associated with a lower T2/CSF value and larger T2/FLAIR-CE mismatch, whereas K-B fusion was associated with a higher T2/CSF value and smaller T2/FLAIR-CE mismatch [2].

Case reports

2015

A 7-year-old boy was referred to a neurosurgery clinic with headache. Further imaging workup revealed hypothalamic PA. Partial resection of the lesions was performed with right-side pterional approach. The patient developed a severe panmucositis [Stevens-Johnson syndrome (SJS)] and respiratory failure plus conjunctivitis, due to phenytoin allergy. During the patient's 6-month follow-up, postoperative magnetic resonance imaging (MRI) revealed a residual tumor, and about 9 months later (at 15 months postoperatively), the MRI showed total regression of the tumor. Clinically, symptomatic PA may undergo spontaneous regression after partial resection. Samadian et al. report a well-documented case of spontaneous regression hypothalamic PA after partial resection that complicated with SJS. Immune system reaction in SJS may have a role in tumor behavior and spontaneous regression. Multiple studies confirmed spontaneous regression in PA after partial/subtotal resection. This phenomenon occurs due to humoral and cell-mediated host immune responses to the implanted tumor. The immune system reaction in SJS may have a role in tumor behavior and spontaneous regression [3].

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Reis GF, Bloomer MM, Perry A, Phillips JJ, Grenert JP, Karnezis AN, Tihan T. Pilocytic astrocytomas of the optic nerve and their relation to pilocytic astrocytomas elsewhere in the central nervous system. Mod Pathol. 2013 Oct;26(10):1279-87. doi: 10.1038/modpathol.2013.79. Epub 2013 May 24. PubMed PMID: 23702730.

2)
Ishi Y, Yamaguchi S, Yoshida M, Motegi H, Kobayashi H, Terasaka S, Houkin K. Correlation between Magnetic Resonance Imaging Characteristics and BRAF Alteration Status in Individuals with Optic Pathway/Hypothalamic Pilocytic Astrocytomas. J Neuroradiol. 2019 Jun 19. pii: S0150-9861(18)30129-9. doi: 10.1016/j.neurad.2019.05.006. [Epub ahead of print] PubMed PMID: 31228537.

3)
Samadian M, Bakhtevari MH, Haddadian K, Alavi HA, Rezaei O. Spontaneous complete regression of hypothalamic pilocytic astrocytoma after partial resection in a child, complicated with Stevens-Johnson syndrome: a case report and literature review. Neurosurg Rev. 2015 Dec 14. [Epub ahead of print] PubMed PMID: 26662551.