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Leptomeningeal Metastases in IDH-wildtype Glioblastomas Revisited: Comprehensive Analysis of Incidence, Risk Factors, and Prognosis Based on Post-contrast FLAIR

Yae Won Park [1], Geon Jang [2], Si Been Kim [3], Kaeum Choi [4], Kyunghwa Han [1], Na-Young Shin [1], Sung Soo Ahn [1], Jong Hee Chang [5], Se Hoon Kim [6], Seung-Koo Lee [1], Rajan Jain [7 8]

Affiliations

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Abstract

Background: The incidence of leptomeningeal metastases (LM) has been reported diversely. This study aimed to investigate the incidence, risk factors, and prognosis of LM in patients with IDH-wildtype glioblastoma.

Methods: A total of 828 patients with IDH-wildtype glioblastoma were enrolled between 2005 and 2022. Baseline preoperative MRI including post-contrast fluid-attenuated inversion recovery (FLAIR) was used for LM diagnosis. Qualitative and quantitative features, including distance between tumor and subventricular zone (SVZ) and tumor volume by automatic segmentation of the lateral ventricles and tumor, were assessed. Logistic analysis of LM development was performed using clinical, molecular, and imaging data. Survival analysis was performed.

Results: The incidence of LM was 11.4%. MGMTp unmethylation (odds ratio [OR] = 1.92, P = 0.014), shorter distance between tumor and SVZ (OR = 0.94, P = 0.010), and larger contrast-enhancing tumor volume (OR = 1.02, P < 0.001) were significantly associated with LM. The overall survival (OS) was significantly shorter in patients with LM than in those without (log-rank test; P < 0.001), with median OS of 12.2 and 18.5 months, respectively. Presence of LM remained an independent prognostic factor for OS in IDH-wildtype glioblastoma (hazard ratio = 1.42, P = 0.011), along with other clinical, molecular, imaging, and surgical prognostic factors.

Conclusion: The incidence of LM is high in patients with IDH-wildtype glioblastoma, and aggressive molecular and imaging factors are correlated with LM development. The prognostic significance of LM based on post-contrast FLAIR imaging suggests acknowledgement of post-contrast FLAIR as a reliable diagnostic tool for clinicians.

Keywords: Glioblastoma; Leptomeningeal Metastases; Magnetic Resonance Imaging; Prognosis; Risk Factors.