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Metastasis of World Health Organization Grade II and Grade III Meningiomas: Long-Term Survival and Associated Factor Analysis

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Abstract

Objective: Metastasis of World Health Organization (WHO) grade II or grade II meningiomas are rare. The aim of this study was to investigate their incidence, associated risk factors, and treatment course.

Methods: Patients with surgically resected WHO grade II or grade III meningiomas were reviewed based on histopathology with the 2016 WHO criteria. Metastasis was diagnosed through whole body image scan followed by surgical resection or biopsy. Clinical factors were analyzed for their association with metastasis.

Results: Among the 131 enrolled patients, metastasis was diagnosed after tumor relapse in 7 (incidence rate 3.6%) at a mean 30.9 months after the initial surgery. The metastasis after tumor relapse group had the worst overall survival, followed by tumor relapse without metastasis and nonrelapse groups ($P < 0.001$). The independent factors associated with metastasis were major vessel compromise by primary tumors (hazard ratio [HR] = 9.9, $P = 0.035$), tumor relapse time less than 24 months (HR = 7.0, $P = 0.036$), and subtotal resection without adjuvant radiotherapy to the primary tumor (HR = 3.5, $P = 0.047$). Neither grading nor histochemical staining was significantly associated with metastasis, whereas higher vascularity seemed to be more common in metastatic lesions than primary tumors.

Conclusions: The presence of metastasis contributed to poor outcomes and was related to earlier tumor relapse and major vessel compromise. Subtotal resection should be followed by adjuvant radiotherapy to reduce the risk of metastasis. Further research is warranted to identify circulating or pathologic biomarkers for the early detection of metastasis.

Keywords: Anaplastic meningioma; Atypical meningioma; Metastasis; WHO grade II; WHO grade III.