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Gamma Knife surgery for metastatic brain tumors from primary breast cancer: treatment indication based on number of tumors and breast cancer phenotype. Clinical article.

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Abstract

OBJECT: The goal of this study was to analyze prognostic factors for local tumor control and survival and indications for initial treatment with the Gamma Knife in patients with up to 10 metastatic brain tumors from primary breast cancer.

METHODS: Outcomes were retrospectively reviewed in 101 women with a total of 600 tumors, who underwent Gamma Knife surgery (GKS) for metastatic brain tumors between April 1992 and December 2008 at 1 institution. The inclusion criteria were up to 10 brain metastases, maximum diameter of tumor < 3 cm, and total tumor volume < 15 cm³. The exclusion criteria were poor systemic condition, presence of carcinomatous meningitis, and previous whole brain radiation treatment and/or craniotomy.

RESULTS: The mean tumor volume at GKS was 3.7 cm³ (range 0.016-14.3 cm³). The mean margin dose was 19 Gy (range 8-30 Gy). Neuroimaging showed that the local tumor growth control rate was 97%, and the tumor response rate was 82.3%. Larger tumor volume ($p = 0.001$) and lower margin dose ($p = 0.001$) were significant adverse prognostic factors for local tumor growth control according to a multivariate analysis. The number of brain metastatic lesions was 4 or fewer in 76 patients and 5 or more in 25 patients. The median overall survival time was 13 months. Multivariate analysis revealed that the presence of extracranial metastases ($p = 0.041$) and lesions that were not the human epidermal growth factor receptor-2 (HER2)-positive type ($p = 0.001$) were significant adverse prognostic factors for overall survival. The number of brain metastases was not statistically significant, except for a single metastasis. The median new lesion-free survival time after initial GKS was 9 months. Five or more lesions at initial GKS ($p = 0.007$) and younger patient age ($p = 0.008$) reduced survival significantly. The prevention of neurological death after GKS was 93.9% at 1 year, and a lower Karnofsky Performance Scale score ($p = 0.009$) was the only unfavorable factor. Median overall survival associated with the HER2-positive phenotype was significantly longer than survival associated with the other phenotypes (luminal and triple-negative). There were no statistically significant differences between the 3 breast cancer phenotypes for the incidence of new brain metastases after initial GKS.

CONCLUSIONS: Initial GKS resulted in excellent local tumor control rates, which were associated with prolonged survival and a low risk of neurological death for patients with up to 10 metastatic brain tumors from primary breast cancer. The authors recommend periodic clinical and neuroradiological follow-up examinations after GKS in patients with 5 or more lesions at initial GKS, because they carry a high risk of development of new brain metastases, and in patients with the HER2-positive phenotype, because they tend to have a favorable prognosis in overall survival. Last, the authors recommend additional GKS or whole-brain radiation treatment for salvage treatment if new brain metastases occur.

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