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Navigating the Thalamus: Role of Stereotactic Radiosurgery in the Management of Brain Metastases: A Retrospective Study from a Single Institution

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Abstract

Objectives:

The thalamus, known as the neural processor and integrator for forebrain activities, is an uncommon site for metastatic lesions. Stereotactic radiosurgery (SRS) has become a key non-invasive treatment for brain metastases. This study evaluates the efficacy and safety of SRS for BM in thalamus.

Methods:

We retrospectively reviewed cases of BM in thalamus treated with SRS at our institute between 2002 and 2024. A total of 49 lesions from 47 patients were included. Demographic, clinicopathologic, radiologic and treatment data were collected. Statistical analyses included Logistic Regression, Chi-square, Mann-Whitney U tests and Kaplan-Meier analysis.

Results:

The mean follow-up was 18.92 months (SD: 20.95 months). The mean age at diagnosis was 58.49 years (SD: 13.53 years) and 59.2% were female. The median size of the BM was 1.0 cm (IQR: 0.50-1.95 cm). There were statistical significances in the following; the patients without a genetic mutation had pre-SRS thalamic aphasia more frequently than those with a genetic mutation (25.9% vs. 4.5%, p = 0.044). Longer intervals between the Dx of primary tumor and metastasis are associated with larger target volumes for the metastases (p = 0.018). Larger thalamic tumors are significantly associated with increased local recurrence (p = 0.025). Higher maximum radiation doses are significantly associated with reduced tumor recurrence (P= 0.042). ROC analysis revealed 24Gy to be the Dmax predictive of treatment response with AUC of 0.813 and sensitivity of 92.7%. Multivariate analysis revealed Dmax to be the only independent predictor of local tumor control (p=0.033). Pre-SRS thalamic aphasia (p = 0.028) is significantly associated with reduced symptom resolution following treatment. The cumulative 6-months, 9-months, 12-months and 24-months local control rates were 100%, 90%, 82.5%, and 77.6% respectively. The overall survival rates were 81.4% at 6 months, 68.3% at 12 months, 52% at 18 months, and 40.5% at 24 months.

Conclusion(s):

Our results showed the sufficient local control following the treatment. SRS demonstrates strong efficacy and safety with high cumulative control rates sustained over time, supporting its role as an effective treatment option.