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Brainstem Metastases Treated with Stereotactic Radiosurgery: Masked vs. Framed Immobilization

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Abstract
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Abstract

Objectives:

To review the efficacy of treating brainstem metastases with Gamma Knife stereotactic radiosurgery (GK SRS) in regard to both local control (LC) and toxicity, with specific interest in comparing results based on the utilization of mask-based or frame-based immobilization.

Methods:

32 patients with 49 lesions treated with GK SRS between 2014 - 2022 were included. Patient demographic and treatment characteristics were collected. We retrospectively reviewed clinical and radiographic outcomes to analyze local control rate and objective response rate (ORR) for comparison between mask and frame-immobilized groups. Of these 32 patients, 50% were female, average age of patients was 62 years (range: 19 – 87), and median KPS at time of treatment was 80 (range: 50-100). Most common primary cancers were lung (13), breast (8), and melanoma (3). The majority of lesions (84%) were located in the pons. 18 (36%) lesions were treated with mask immobilization. Average tumor volume was 0.99 cm3 (range: 0.005 – 13.3 cm3). 39 (80%) lesions were treated in a single fraction with a median prescribed dose of 16 Gy (range: 12 – 20 Gy). 10 (20%) lesions were treated in 3-5 fractions with a median prescribed dose of 22.5 Gy (range: 18 – 27 Gy).

Results:

Mean follow-up was 14.2 months (range: 1.2 to 48.2 months). One local failure was seen in a patient with a 0.015 cc pontine metastasis from colon cancer who was mask-immobilized for treatment with 14 Gy. 1-year local control rate for this cohort was 94.7%. There was no statistically significant difference between ORR at last follow up for patients treated with frame-based or mask-based immobilization ($p = 0.81$), or between patients treated with single vs. multiple fractions ($p = 0.09$). No cases of radiation necrosis occurred in either group.

Conclusion(s):

SRS for patients with brainstem metastases achieved a high rate of local control despite variability in both tumor size and histology with no significant difference in ORR between patients treated with mask-based and frame-based SRS. Additionally, there were excellent ORRs with no difference between lesions treated with single fraction vs. hypo-fractionated SRS. Although clinical trials have historically excluded patients with brainstem metastases, our data supports the growing body of literature proving that SRS is a safe and efficacious treatment option for these patients. To our knowledge this is the first study that has shown that mask-based immobilization provides equivalent, successful outcomes when compared to frame-based immobilization for the treatment of patients with brainstem metastases.