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Long-Term Outcomes of Fractionated Stereotactic Radiosurgery (fSRS) for Benign Meningioma

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Abstract
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Abstract

Objectives:

Radiation is commonly used to treat intracranial meningiomas. Various radiation dosing regimens exist due to tumor size, location, and patient preference. Meningiomas are slow-growing, necessitating long follow-up periods to gather meaningful clinical data. This study evaluated the long-term outcomes of patients with benign meningiomas treated with fSRS at our institution.

Methods:

This is a retrospective review of all patients diagnosed with meningioma at our institution who received fSRS (5 fractions). Clinical data, including tumor location, size, prior treatments, demographics, radiation dosimetric information, tumor response and survival were collected. Kaplan-Meier curves were used to assess local control. Acute and late toxicities were evaluated as well. Patients were included for analysis if they had atleast one post-treatment MRI following therapy.

Results:

93 patients with benign meningioma treated between 2013 and 2022 were identified with 82 included for analysis (n=11 excluded due to lack of post-treatment follow-up). The median age was 66 years (range 21-90), with 79.5% identifying as White, 13.6% as Black, 2.3% as Asian, 1% identifies as Hispanic, 1% as Native American, and 2% identified as other. The median Karnofsky Performance Status (KPS) before treatment was 90 (range 50-100). Half of the patients (n=41) had prior surgical resection, with 34.1% (n=15) achieving gross total resection (GTR). About 9% (n=8) had received prior radiation for the treated meningioma. Tumor locations included the cerebellopontine area (11.3%), prepontine and cerebellar areas (7.9%), parasagittal or parafalcine regions (10.2%), cavernous sinus (15.9%), olfactory groove (2.3%), sphenoid area (9.1%), and various other intracranial sites (43.2%). Seventeen patients were treated with gamma knife (GK), while the remainder received treatment via TrueBeam Linac. The median tumor volume was 6.9 cc (range 0.4-126.3 cc), and the median planning target volume (PTV) was 11.3 cc (0.4-126.3 cc). The median mean PTV dose of 26.65 Gy and minimum and maximum doses of 22.61 Gy and 28.55 Gy, respectively. With a median follow-up of 27.7 m, the 1y, 3 5y local control rates are 94.47%, 90.59%, and 86.96% respectively. When conducting a subgroup analysis excluding patients previously treated with radiation local control improved to 95.64%, 94.07%, and 90.15% at 1, 3, and 5y respectively. A minority of patients presented with radionecrosis, with survival without radionecrosis calculated at 96.5%, 93.4%, and 93.4% at 1, 3, and 5 years respectively. When tumors were categorized by size as small (< 3cc), large (3-10cc), and very large (>10cc), Chi-squared analysis showed no difference in the rate of failure (p= 0.44)

Conclusion(s):

The SRT regimen of 25 Gy in 5 fractions effectively achieves local control in low-grade meningiomas. Many patients had prior radiation or surgery, with some cases revealing high-grade disease. These findings highlight the need for further clinical studies to better understand grade 1 meningiomas.