

Analysis of MRI Volumetric Changes Following Hypofractionated Stereotactic Radiosurgery for Benign Intracranial Neoplasms

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Introduction

Few studies exist evaluating the role of 3D-MRI volumetric changes as a quantitative measure of tumor progression or regression after hypofractionated stereotactic radiosurgery (HFSRS) for benign intracranial neoplasms (BIN). We quantitatively assessed volumetric changes following HFSRS in patients treated for vestibular schwannomas, meningiomas, and non-functioning pituitary adenomas.

Methods

We conducted a retrospective study of patients treated with LINAC HFSRS for BIN. Patients received 25 Gy in 5 fractions or 21 Gy in 3 fractions to the tumor with a median 2mm planning target volume. Following treatment, they underwent follow-up with 3D-MRI at 3-12 month intervals. Gross tumor volume was outlined and analyzed on each thin slice of contrast-enhanced T1 series before and on each scan after HFSRS.

Results

There were 47 patients undergoing 197 MRI scans between 2002-2014. Pathology included vestibular schwannoma (N=34), meningioma (N=9), and pituitary adenoma (N=4). Median follow-up time was 30 months. Average tumor volume was 3.1 cm³. For the entire cohort, decrease in tumor size occurred in 29/47 (62%) of patients with a mean relative volume reduction of 36%. For vestibular schwannoma patients, 56% decreased in volume, 29% remained stable, 15% had progressive expansion (with one patient requiring subsequent surgical excision), and 65% of these patients experienced a transient volume expansion. For meningioma patients, 78% decreased in volume, 22% remained stable, and 33% experienced a transient volume expansion. For non-functioning pituitary adenoma patients, 75% decreased in volume, and 25% remained stable, with no increase in size observed. For all patients, transient volume expansion with subsequent regression occurred within a median time of 6 and 13 months, respectively. Local control was 90% for the entire cohort. There were no grade 3 or 4 toxicities noted in any patient.

Conclusions

After volumetric analysis, our results indicate that HFSRS provides excellent local control with minimal toxicities in patients with selected BIN.

Learning Objectives

By the conclusion of this session, participants should be able to: 1. Understand and describe the ability to determine volumetric tumor change by 3D-MRI analyses after HFSRS for BIN.

2. Discuss in small groups the local control rates and toxicities of the HFSRS for BIN.

3. Understand that transient volume expansion after treatment with HFSRS can occur but only rarely leads to morbidity

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