

The Use of Self-shielding Gyroscopic Radiosurgery – A First Prospective Evaluation

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Abstract

Objectives:

Stereotactic radiosurgery (SRS) is an established treatment modality for various intracranial tumors. There are several treatment systems that can deliver SRS, including the Gamma Knife®, CyberKnife®, and other LINAC-based options. The delivery of radiosurgical treatments requires several safety precautions, including a vault to prevent the unintentional spread of ionizing radiation. Thanks to the development of self-shielding gyroscopic radiosurgery (GRS), delivered with the ZAP-X®, it is now possible to deliver such treatments without the need of a radiation vault. Given its novelty, prospective evidence for its use in the daily routine is lacking. This work aims to provide the first prospective data on the use of GRS in this setting.

Methods:

This single-institutional, prospective analysis included patients treated with GRS between December 2021 and September 2022. Treatments for either benign or malignant tumors were eligible. Patient, disease, and treatment characteristics were obtained and summarized. Patient satisfaction was measured during the first available follow-up on a five-level Likert scale (“1” to “5”, “1” standing for “very satisfied” and “5” standing for “very disappointed”). Follow-up frequency was dependent on the tumor type. Adverse events (AE) were rated according to the Common Terminology Criteria for Adverse Events v5.0.

Results:

A total of 113 patients were prospectively enrolled. The most common tumor entities comprised vestibular schwannoma (VS) (56 patients), meningioma (24 patients), and brain metastases (BM) (23 patients). The median prescription dose and isodose line for benign tumors were 13 Gy and 56%, respectively, and for malignant tumors 20 Gy and 60%. The median number of isocenters and beams were eight and 102, respectively. GRS was the primary treatment modality in the majority of cases (101 patients). All treatments were applied in one fraction. The median planning target volume was 1.08 cc. No system failures occurred during treatment delivery. For 29 patients, a first follow-up after GRS was available. The median follow-up was 5.7 months. The most frequent tumor types in this patient cohort included 13 VS, 11 BM, and three meningiomas. The median age at treatment was 57.4 years, and the majority of patients were female (16 patients). None of the treated tumors showed signs of tumor progression based on magnetic resonance imaging and assessment by a board-certified radiologist. Recorded AE grade ≥ 3 comprised a vertigo grade 3 and one facial and trigeminal nerve disorder grade 3 in two patients with VS. Affected patients were suffering from the reported symptoms before treatment but showed worsening afterwards. The median patient satisfaction on the five-level Likert scale was 1 (i.e., “very satisfied”), with a total of 22 votes. No patient was unsatisfied with the treatment experience (i.e., “ >2 ”).

Conclusion(s):

To the best of our knowledge, this study represents the first prospective analysis on the use of GRS. While a follow-up is only available for a small proportion of enrolled patients at the moment, the overall treatment experience was favorable. High-grade AE occurred occasionally. We eagerly await more long-term results and will report in-depth quality of life analyses for the various treated tumor entities in the future.