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Gyroscopic Radiosurgery – Clinical Experience and Prospective Analysis of over 500 Treated Tumors

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Abstract
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Abstract

Objectives: Stereotactic radiosurgery plays a significant role in the treatment of various benign and malignant tumors of the central nervous system. Recently, the first self-shielding treatment platform for gyroscopic radiosurgery (GRS) was introduced. Given the limited prospective evidence of its use, we report our treatment experience with GRS of the first 541 tumors in the setting of a prospective clinical study.

Methods: This prospective study enrolled patients who underwent GRS for any intracranial tumor at a single institution. Patient, treatment, and outcome data were collected and analyzed. Only patients with at least one imaging and clinical follow-up were included in this analysis. We also report data on tumor volumetry and toxicity.

Results: A total of 491 patients were treated with GRS between 2021 and 2024. Of those, 382 patients harboring 541 tumors underwent at least one imaging and clinical follow-up at the time of analysis. The majority of tumor entities treated were vestibular schwannomas (196), brain metastases (188), and meningiomas (113). The median prescription dose for brain metastases was 20 Gy. For meningiomas and vestibular schwannomas, the median prescription doses were 15 and 13 Gy, respectively. All patients underwent single-fraction GRS, there were no fractionated treatments. Analyses of the dosimetry showed that GRS treatments are highly conformal, achieving steep dose gradients. The median total treatment time was 46 minutes, which increased with the number of beams, monitor units, and isocenters (all $p < 0.01$). Most treatments were completed in an hour or less (76%). The median imaging follow-up was 10.6 months. Volumetry of the treated targets demonstrated an early treatment effect, with either tumor volume reduction or stability for most tumors. High-grade toxicity was rare.

Conclusion(s): The early results of this prospective study suggest the efficacy and safety of self-shielding GRS in the management of intracranial tumors. Although longer imaging and clinical follow-up are mandatory to assess the treatment's long-term efficacy and safety, the preliminary treatment experience is favorable.