

Gamma Knife® radiosurgery Acoustic Neuroma



Introduction

Acoustic Neuromas (vestibular schwannomas) are generally slow-growing, intracranial extra-axial benign tumors that usually develop from the vestibular portion of the eighth nerve. A progressive unilateral hearing decline is the most common symptom that leads to the diagnosis of a vestibular schwannoma.

During the past two decades radiosurgery has emerged as an effective alternative to surgical removal of small to moderate-sized vestibular schwannomas. Long-term results have established Gamma Knife® radiosurgery as an important minimally invasive alternative to resection. Advanced multiisocenter dose planning software, high resolution MRI for targeting, dose optimization, and robotic delivery reflect the evolution of this technology. The goals of vestibular schwannoma radiosurgery are to prevent further tumor growth, preserve neurologic function where possible, to avoid the risks associated with open resection, and in selected patients to improve pre-existing symptoms.

Gamma Knife Radiosurgery Technique

Patients with vestibular schwannomas are evaluated with high resolution MRI and audiological tests that include pure tone average (PTA) and speech discrimination score (SDS) measurements. Dose planning is a critical aspect of radiosurgery, and Leksell GammaPlan® software provides the platform for reliable tumor irradiation. Complete coverage of the tumor and preservation of facial, cochlear and trigeminal nerve function is given priority during dose planning. For large tumors, preservation of brainstem function is also a consideration.

Vestibular schwannoma planning is usually performed using a combination of small beam diameter (4 and 8mm) collimators. A series of 4mm isocenters are used to create a tapered isodose plan to conform to the intracanalicular portion of the tumor. In Gamma Knife® radiosurgery a dose of 12-13Gy is typically prescribed to the 50% isodose line that conforms to the tumor margin.

Clinical Results

Recent reports suggest a tumor control rate of 93–100% after radiosurgery. Kondziolka et al studied 5-10 year outcomes in 162 vestibular schwannoma patients who had radiosurgery at the University of Pittsburgh. In this study a

long-term 98% tumor control rate was reported. Sixty-two percent of tumors became smaller, 33% remained unchanged, and 6% became slightly larger.

Hearing Preservation

Pre-radiosurgery hearing can now be preserved in 60–90% of patients, with higher preservation rates found for smaller tumors. In a long-term (5–10 year follow-up) study conducted at the University of Pittsburgh, 51% of patients had no change in hearing ability. A recent research has shown that the mean cochlear dose is important for hearing preservation. A dose of <4Gy was associated with better hearing, a finding similar to that of other centers. Age is also important with those under 60 years old faring better. Long-relaxation time (T2) volumetric images are important to identify the cochlea for dose planning.

Conclusion

Gamma Knife® radiosurgery has become a well documented management option for patients with vestibular schwannomas that is both safe and effective over the long-term. Data past ten years of follow-up are now published, and systematic, serially collected outcomes data are available on patients with for this tumor. Radiosurgery may currently be the most common treatment choice for patients.

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