Commentary: Long-Term Hearing Outcomes Following Stereotactic Radiosurgery in Vestibular Schwannoma Patients—A Retrospective Cohort Study

Vestibular schwannoma (VS), colloquially known as acoustic neuroma, is a rare tumor of the vestibulocochlear nerve with a prevalence of approximately 3300 in the United States and incidence of approximately 10 to 25 cases per million. VS has a benign natural history, with a mean growth rate of <$2 mm/yr. However, with close proximity to the vestibulocochlear apparatus and cerebellopontine angle, even small lesions may lead to such symptoms as hearing loss, tinnitus, vertigo, facial numbness, and otalgia.

Options in the management of VS include observation, surgical intervention, and radiation therapy. Since the seminal work of Leksell demonstrating excellent outcomes with stereotactic radiosurgery (SRS), this has been the preferred radiation-based technique whether by Gamma Knife radiosurgery (GKRS; Elekta AB, Stockholm, Sweden) or linear accelerator-based methods, such as Cyberknife (Accuray Inc, Sunnyvale, California). Utilization of different treatment approaches varies by geography and institution with numerous factors influencing the decision to intervene and the modality that is applied. Given the rarity of the tumor and long-term follow-up required to assess outcomes, Level I evidence is lacking to help standardize management, which makes observational and high-quality retrospective data of great value.

Santa Maria et al provide a rigorous assessment of their institutional experience with SRS for VS. In this retrospective study, 473 tumors treated with Cyberknife SRS over a span of 21 yr were included and had an average follow-up of 5.5 yr. The authors are commended on their efforts to collate and analyze this database as well as adhere to reporting standards for this type of work with the inclusion of individual patient data that may advance future investigations. A wealth of information may be deduced from this investigation, but the primary conclusion—that SRS is associated with a high rate of hearing decline—and what it means for treatment recommendations deserves special considerations.

Hearing may decline in patients with VS in the absence of treatment and, in some patients, even in the absence of tumor growth. In a prospective study of conservative management with MRI surveillance for VS, the subgroup of patients who demonstrated no growth or growth <1 mm/yr still experienced a 40% decline in speech discrimination scores and a mean decline in pure tone average of 36 dB after a median follow-up of 10 yr. Another prospective study employed close observation in an effort to avoid empiric treatment for VS. Over one-third of patients failed observation, consistent with other reports, and patients who had less than perfect speech discrimination scores at diagnosis had only a 55% chance of maintaining good hearing at the end of the 10-yr follow-up period. In another study of observation, audiometry analyses showed the mean rate of hearing decline was numerically worse during the surveillance period (5.39 dB/yr) than after SRS (3.77 dB/yr) though the difference was not statistically significant. In the same way that clinicians must use caution when recommending empiric treatment for VS, these data remind us that conservative management also carries risks.

A valid argument for conservative management is that, although observation may be associated with hearing decrements, the time-course of decline is likely protracted relative to the adverse effects of treatment. To be sure, while surgical intervention may acutely impair hearing and SRS may lead to a steady decline over many months to a few years, the negative effects of close observation typically develop only after many years of follow-up. As with most controversies in oncology, the essence of the matter is patient selection, and this highlights the strength of Santa Maria and colleague’s data.
When considering options in the management of VS, one may favor observation for small, asymptomatic tumors, particularly in elderly patients. Observation typically involves surveillance MRI every 6 to 12 mo initially along with audiology at a similar interval and then less frequent monitoring following a period of stability. Reluctance to utilize this strategy may derive from a fear of tumor growth prior to the initiation of treatment. While it is true that larger tumors de novo might be associated with increased toxicity, the impact of asymptomatic growth while under observation is not well understood. Santa Maria et al did not identify any differences in hearing function based on pre-SRS tumor growth and, though it is difficult to prove the negative, this should allay some concerns regarding the conservative management strategy.

Although their data highlight the risks associated with SRS and promote the safety of close observation, a major limitation is the lack of even basic cochlear dosimetric information. It is well established that the dose to the cochlea is one of the most important considerations in SRS planning for VS as it is directly related to the risk of hearing loss. The authors cite this limitation and explain that a large number of their patients were treated before it was realized that cochlear dose is important. This suggests that the dose to the cochlea was not controlled in these treatments, which would put the hearing apparatus at increased risk. The magnitude of this risk cannot be directly determined because these data are not reported, but the authors point to a separate publication of a subgroup of their patients where cochlear dose was described.

We can infer from these data that the majority of patients received over 4 Gy per fraction to the cochlea, which is often considered a safe dose constraint, and suggests at least a moderate risk of hearing impairment with the SRS treatment delivered in the current study.

There are innumerable considerations when embarking on a management strategy for patients with VS and despite a plethora of prospective and some prospective observational studies, physicians must make clinical judgments without definitive scientific evidence. We agree with Santa Maria et al that prophylactic SRS is not appropriate in every case, but would emphasize that a modern understanding of the outcomes of conservative management, radiobiology, and radiation dosimetry provides a more balanced basis for discussion with patients and as an interdisciplinary team.

Disclosures

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REFERENCES