


**RESPONSE:** We are grateful to Dr. Prasad for his comments about our paper.

For over 15 years the radiosurgery community has been comparing gamma knife with LINAC radiosurgery. Several authors examined their pros and cons as to mechanical, physical, and gadgetry considerations. Depending on each author’s predilection or experience, pitfalls in one or the other approach have been found.

We believe that in judging the relative quality of different modalities for radiosurgery, the only effective and objective measure should be the patients’ outcomes. That is the reason why papers with good patient follow up should be written and published in the neurosurgical literature. The paper by Prasad, et al., is exemplary in this respect. Our humble contribution is an effort to continue in this tradition.

In his commentary, Dr. Prasad stated: “. . . it is clear that the 0.5-mm figure stated by the authors is the reproducible average of isocentric accuracy measured from time to time. In a system in which the patient and the gantry or both are rotated in a continuing manner, variations of this number are certain.” Actually, our 0.5-mm isocentric accuracy is the figure measured for each and every treatment with a phantom target, across the whole range of movement of both the patient’s couch and the LINAC gantry, with the patient resting on the couch before treatment is delivered (using the method of virtual simulation, as described several years ago).1,2

We completely agree with Dr. Prasad’s statement that isocenter instabilities are only one of many potential inaccuracies (such as frame stability, radiological determination of coordinates, the algorithm for radiation distribution used, and patient positioning) inherent in each and every step in the radiosurgical process and that errors may be cumulative. Each step is to be accomplished with utmost care. With regard to our use of one isocenter for most acoustic neuromas treated in the series, Dr. Prasad wrote: “. . . I do not think there is any justification for using a single isocenter other than that of convenience. No amount of publications . . . would justify even apparently harmless doses of ionizing beams being deposited in structures outside the target area.”

As stated in our paper, we have never seen radiological or clinical signs of radiation injury due to exposure of small volumes at the posterior aspect of the petrous bone and cerebellar cortex in the one-isocenter treatment plan. Multiple isocenters within the small volume of an acoustic neuroma nicely approximate conformity at the isodose level selected for the treatment dose. However, in most gamma knife radiosurgeries, the treatment dose is delivered to the 50% isodose line. The 20% isodose line depicted in demonstration images of these multiple isocenter plans actually represents 40% of the treatment dose and certainly involves larger areas of normal tissue than any single-isocenter plan. Although this apparently does not result in any untoward effect, the mean time for development of radiation-induced secondary tumors is longer than the mean follow-up period in most radiosurgical series. This is particularly true with respect to the use of a large number of isocenters, a technical leap made possible by increased computer power only in the last few years. With the introduction of miniplate collimators, the goal of perfect conformity with a single isocenter is within reach. Again, these are theoretical truths that so far have not been proven to correlate with outcome.

Our series is now being reported with a relatively short follow-up time. Our main objective was to state the decisive role of treatment radiation dose in the incidence of early and early-delayed complications, as well as the apparent lack of effect of dose reduction on the incidence of tumor control within this time frame.

We believe that our experiences prove these points, as well as the much more extensive experience published by gamma knife users.

Since the submission of this paper, our series has increased to include 103 acoustic neuromas. Of the 70 patients followed for at least 1 year, two developed minor and transient facial paresis and two experienced transient facial hypesthesia. Our current treatment dose is 1250 cGy. Much longer follow-up period periods will be required to assess the impact of these lower, safer radiation doses in long-term tumor control.

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**References**


**Vestibular Schwannomas: Surgical Approach**

To The Editor: In this issue, Dr. Sluyter and coworkers have analyzed the results of surgical treatment from 1986 to 1999 of 120 acoustic neuromas by using the combined translabyrinthine–transpetrosal approach (Sluyter S, Graamans K, Tulkeven CAF, et al: Analysis of the results obtained in 120 patients with large acoustic neuromas surgically treated via the translabyrinthine–transpetrosal approach. *J Neurosurg* 94:61–66, January, 2001). The majority (83%) of these tumors were larger than 3 cm. Total tumor resection was achieved in 92% of the cases in this series. There were no deaths. Morbidity included facial nerve injury (20%), meningitis (10%), aphasia (20% in left-sided tumors), hemiparesis (45%), and permanent seizure (3%). Hearing was lost in all patients who under-
went the translabyrinthine approach. Long-term postoperative facial nerve function follow up included 56% of patients with House–Brackmann Grade I or II. The authors chose the combined translabyrinthine–transtentorial approach because it “provided a wide exposure at the expense of bone rather than brain tissue.” Finally, they concluded that the “combined translabyrinthine–transtentorial approach is a safe route for removing acoustic neuromas with a diameter of 2 cm or more.”

A careful analysis of this paper reveals several aspects that must be discussed. This series of 120 acoustic tumors included tumor sizes larger than 2 cm in diameter, which corresponds to our tumor size classes T3 and T4. The present series represents the collaboration of surgeons from two institutions, who together treated a total of 248 cerebellopontine angle tumors over a 14-year period. These numbers represent fewer than 18 surgical procedures per year or 1.5 surgeries per month. In the series published in 1997, a total of 800 neuromas larger than 3 cm in diameter were surgically removed by the senior author of this letter (M.S.) by using the retrosigmoid–suboccipital approach. Total tumor resection was achieved in 99% of cases. The facial nerve was preserved in more than 90% of cases and the hearing preservation rate was better than 30%. Cerebrospinal fluid (CSF) leakage requiring surgical revision occurred in 1.6% of cases and bacterial meningitis in 1.3%.

We do not share the authors’ impression that in the suboccipital approach the lower cranial nerves are in the surgical access route and thus at special risk. On the contrary, the suboccipital approach permits removal of tumors of all sizes, giving a chance of hearing and facial nerve preservation. Two decades ago the combined retrolabyrinthine–transtentorial (retrosigmoid–subtemporal) approach was developed and frequently used by the senior author of this letter to treat tumors in the petroclival region. With increased experience in treating these lesions, however, we have learned that a number of these tumors can be treated safely without major exposure of the petrous bone structures. Avoidance of large petrous bone resections may significantly reduce the risk of surgical complications such as hearing loss, facial palsies, and CSF leakage. Recently, a modified retrosigmoid approach has been used to treat even large petroclival lesions.

It is not our impression that tumor size should dictate a change in the surgical approach to acoustic neuromas. Rapid reduction in tumor size can be achieved by debulking the lesion with cavition ultrasonic aspiration. The retraction of cerebellum is minimal when using the suboccipital approach and less harmful than temporal lobe retraction. The high incidence of aphasias reported in the present series underlines the risks of temporal lobe retraction, particularly on the left side.

We thank the authors for this careful study, but one must conclude that, because of the increased morbidity rate associated with it, the combined translabyrinthine–transtentorial approach is not suitable for resection of acoustic neuromas, even large ones.

REFERENCES


RESPONSE: The combined translabyrinthine–transtentorial approach is an extension and in some respects a continuation of the translabyrinthine approach. The safety of the latter approach is well attested in large surgical series, and it has proved equally effective compared with the retrosigmoid approach in experienced hands. Differences in complication rates were found to be associated with that approach compared with the suboccipital approach, especially with regard to preservation of facial nerve function and prevention of CSF leakage. At our institution the classic translabyrinthine approach is used to treat patients with acoustic neuromas smaller than 2 cm in diameter who lack useful hearing, whereas the retrosigmoid approach is used in patients with acoustic neuromas who have some useful hearing. The combined translabyrinthine–transtentorial approach is used to treat patients with acoustic neuromas larger than 2 cm who have lost useful hearing. In these patients hearing preservation is not an option. In exchange for only a small additional amount of subtemporal trephination this method offers a much wider exposure than the translabyrinthine approach alone, permitting superior and inferior as well as proximal and distal access to the tumor throughout the entire procedure. Surgery is performed away from vital structures. Most of the tumors in our series were larger than 3 cm. A scrupulous record was kept of even very temporary or minor complications. The series spanned an extended period of time, and the introduction of facial nerve monitoring—together with further developments in microsurgical technology and increased surgical experience—entailed a learning curve. These facts are quite clearly reflected in our article in the description of improved results with the use of the facial nerve stimulator. After the introduction of this instrument, we were able to achieve total tumor resection in 95% of cases and long-term Grade I or II facial nerve function was preserved in 72% of these patients. The presence of serious hearing loss was a prerequisite for using our approach. The mild hemiparesis noted in some patients never lasted longer than a few days. In series involving the suboccipital approach to acoustic neuromas, damage to the caudal cranial nerves has been reported to occur in more than 5% of cases, and new deficits in cere-