Editorial

Linear accelerator radiosurgery for vestibular schwannomas

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There may be no other intracranial neuropathological entity whose proper treatment arouses as much controversy as vestibular schwannoma (VS). Neurosurgeons cite microsurgical study data to justify removing these tumors via the retrosigmoid (suboccipital) or middle cranial fossa approach. Otolaryngologists sacrifice the inner ear through a translabyrinthine approach in an attempt better to expose and preserve the facial nerve. As any intracranial surgeon will attest, these three approaches are attractive not only because of the possibility of a cure through gross-total resection of the tumor but also as a result of the sheer beauty of the neuroanatomy encountered and the technical challenges they present.

Radiosurgery’s proponents cite excellent tumor control and low morbidity, but they must also acknowledge that although the tumor often shrinks, the patient is not cured. Therefore, it is in the best interest of our patients that long-term outcome following treatment with any of these three modalities be thoroughly and scientifically evaluated. Small series, anecdotal evidence, and personal beliefs should not unduly influence the advice we give our patients.

The first radiosurgical treatments of VS were performed by Leksell and Steiner in 1969. Since then more than 21,000 patients with these lesions have undergone radiosurgery. The indications for radiosurgical treatment of VS vary. Some physicians advocate the technique in patients unwilling or unable to undergo microsurgery, whereas others advocate its use in those with postoperative residual or recurrent tumor. This latter notion recalls the work of Wallner, et al., who demonstrated that external-beam radiation lowered the postoperative recurrence rate from 46 to 6% in Boldrey’s surgical series at the University of California, San Francisco. Still others advocate radiosurgery as the treatment of choice in nearly all cases of VSs.

The fact is that for a number of reasons few neurosurgeons acquire the necessary competence to extirpate these tumors. The late Dr. Leonard Malis, one of those highly competent VS neurosurgeons, wrote, “It has taken a long time to convince me, but I now have come to believe that over the next generation, GS [Gamma surgery] will be the mainstay of vestibular neurona care, with surgical resection being the exception, which is reserved for those needing urgent decompression or the very young patient.”

In their article in this issue of the Journal of Neurosurgery, Friedman and colleagues add to the neurosurgical literature by detailing their experience with linear accelerator–based radiosurgery in 390 patients with VSs. The 5-year actuarial tumor control rate was 90%. They noted a 4.4% rate of facial weakness and a 3.6% risk of numbness following radiosurgery. After adopting a prescription dose rate of 12.5 Gy, rates of facial weakness and numbness each decreased to 0.7%.

Unfortunately, their study does not include data on the rate of hearing preservation. With the proliferation of magnetic resonance imaging and increased awareness of this neuropathological entity, more and more patients with VS have serviceable hearing at the time of diagnosis and initial treatment. In my experience, one of the patient’s first questions is typically about the chance of hearing preservation after radiosurgery.

At the University of Virginia, more than 400 patients with VSs have been treated with Gamma Knife surgery (GKS); the results of some of these cases have been reported previously. Among patients treated primarily with GKS a decrease in tumor size was seen in 81%, no change in 13%, and an increase in 6%. In patients treated with GKS after microsurgery, a decrease in tumor size occurred in 65%, no change in 25%, and an increase in 10%. Notably, although our experience in treating large VSs (that is, tumors ≥ 3 cm in diameter) is minimal, we have observed a 95% tumor control rate in such cases after GKS. Such a result for these large lesions in patients unfit for microsurgery was unexpected.

Among the patients at the University of Virginia, permanent changes in trigeminal sensation occurred in 1.7% and facial paresis occurred in 1.5%. Of the patients with useful hearing before GKS, 58% retained it after radiosurgery, 42% experienced some degree of deterioration, and 31% lost useful hearing. The majority of hearing changes were observed at the 2-year checkup, although some patients experienced auditory changes as late as 8 years postradiosurgery. Authors at other centers have reported similar rates of tumor control, hearing preservation, and complications.

The role of radiosurgery in patients with neurofibromatosis Type 2 is much less clear.

We have not encountered an instance of cerebellar edema.
or hydrocephalus requiring spinal fluid diversion after radiosurgery for a VS, although both of these complications have been reported elsewhere.3,11 Although radiation-induced neoplasia after GKS for VS has not been seen at the University of Virginia, we have observed radiosurgically induced meningiomas in two patients treated for arteriovenous malformations. Other researchers have reported malignant transformation or malignant tumorigenesis after the treatment of VS.5,13,14 Fortunately, the risks of cerebellar edema, hydrocephalus, or neoplasia following radiosurgery in patients with VS appear quite low.

Radiosurgery has substantially altered the treatment paradigm for many patients with VSs, and the work by Friedman and colleagues affirms radiosurgery’s significance in the neurosurgical armamentarium. Despite the favorable risk–benefit profile for radiosurgery, a trained neurosurgeon must thoroughly evaluate a patient clinically and radiologically. In addition, a neurosurgeon must factor the patient’s expectations into the equation before advising a microsurgical or radiosurgical approach. Regardless of the approach taken, patients must have open-ended clinical and neuroimaging follow ups to evaluate the tumor’s response to surgery, assess complications, and provide additional treatment as needed.

References


RESPONSE: We agree completely with Dr. Sheehan’s thoughtful comments about radiosurgery for VSs. Based on extensive experience with surgery and radiosurgery for these tumors, we believe that radiosurgery is the treatment of choice for small tumors (< 3 cm). We make this assertion because the long-term tumor control rates (90% of tumors were unchanged or smaller; 99% required no further surgical intervention during the follow up) and the cranial nerve morbidity rates (0.7% with doses used since 1994) greatly exceed the published results of even the most experienced surgeons. The issue of malignant tumorigenesis has recently been the subject of much discussion. It probably exists but at a frequency tremendously lower than the risk of a serious complication from open surgery. Let’s use our hard-won microsurgical skills on larger tumors and accept the facts about radiosurgery discussed in our paper and many others.

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