Letter to the Editor

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I read with interest the article entitled, "Stereotactic Radiosurgery for Acoustic Neuroma: A Canadian Perspective" by Drs. Ross and Tator.[1] As one of the neurosurgeons involved in the development of the first stereotactic radiosurgical program in Canada,[2] I would like to make a few comments with regards to comparisons between linear accelerators and the gamma knife for stereotactic radiosurgery.

Based on the initial experience gained in treating patients with stereotactic radiosurgery using the linear accelerator, a program was initiated at Yale in 1991 using a modification of the McGill technique previously described.[3] After treating over 100 patients with a variety of intracranial pathologies, including acoustic neuromas, it became readily apparent that for complex shaped lesions, the ability to perform a conformal radiosurgical treatment demanded the utilization of an increasing number of isocenters. This invariably led to longer treatment times, stressing the ability of a busy radiation therapy centre to provide the resources to treat an increasingly large number of patient referrals. To this end an exhaustive search was made to determine which particular radiosurgical system might best suit our needs. Within a short space of time, it became obvious that the gamma knife had distinct advantages over other radiosurgical systems using linear accelerators, both in terms of precision and ability to treat complex shaped lesions. Furthermore, the wish to perform functional radiosurgical procedures (i.e. for trigeminal neuralgia, intractable pain secondary to malignancies and movement disorders) made the acquisition of the gamma knife particularly appealing. After lengthy negotiations with the administration board of our hospital, a decision was made to purchase the gamma knife on the basis of a lease arrangement with a third party investor.

Our decision appears to be amply justified as over 90 patients have undergone gamma knife radiosurgical interventions in the first six months since the machine was installed, although it was initially predicted that approximately 100 patients would be treated in the first year of operation. Nowhere is the difference between a linear accelerator based radiosurgical system and the gamma knife more apparent than in the treatment of acoustic neuromas. Whereas we would typically use between 2-3 isocenters to treat an acoustic neuroma with our linear accelerator based system, we now typically use up to a dozen isocenters, thereby producing a more conformal treatment matching precisely the surface contour of the tumor. Although it is clearly too early to talk about differences with regards to the incidence of cranial neuropathies when comparing the two techniques, given the fact that we use a similar approach to that utilized by the Pittsburgh group[4] (whose incidence of complications has declined markedly since the use of MRI-based imaging), it is not unreasonable to expect that our incidence will be similar.

Mostly unpublished data from many neurosurgical centres using linear accelerator-based radiosurgical techniques to treat acoustic neuromas has by and large demonstrated a higher incidence of cranial neuropathies when compared to the recent data from gamma knife centres. This is undoubtedly due to the fact that the smaller collimator sizes needed to treat acoustic neuromas and other irregular-shaped lesions at the skull base are not readily available in most centres utilizing linear accelerators. It is therefore not surprising that many of these centres have taken an interest in fractionated stereotactic radiation therapy as an alternative to radiosurgery given their higher complication rate. Unfortunately, these well known facts are not mentioned in the few publications dealing with stereotactic radiation therapy for acoustic neuromas.[5,6]

In the final analysis one has to consider the fact that the gamma knife was conceived by a neurosurgeon and created specifically for neurosurgical needs. The linear accelerator has proven to be an invaluable tool for the treatment of cancer throughout the body and remains the primary tool for the majority of radiation oncologists. However, it was never conceived as a radiosurgical tool, although Lars Leksell considered its use for radiosurgery prior to the development of the gamma knife.[7] It may interest the readers to know that 10 years before the first gamma knife was installed in North America, Drs. William Feindel and Gilles Bertrand traveled to Sweden to explore the possibility of installing a gamma knife at the Montreal Neurological Institute. At that time there were only two units in existence, both of which were located in Stockholm in separate facilites. Although funds had been set aside to acquire the machine, the technical difficulties of having the unit loaded with radioactive cobalt sources proved to be too complex and costly, and therefore led to the abandonment of the project.[8] With subsequent changes in the construction of the gamma knife, radioactive source loading and changing has now become a relatively straightforward problem that can be managed easily.

Not surprisingly, many academic centres in the United States that began performing radiosurgery with linear accelerators have subsequently acquired a gamma knife as the volume and complexity of the cases increased. It would therefore appear appropriate and timely (20 years after initially being considered) that Canadian neurosurgeons rally in the cause of bringing the gamma knife to Canada as there is little justification to persist in thinking that radiosurgery for acoustic neuromas and other skull-based tumors can be performed just as well with linear accelerator-based radiosurgical techniques.

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Reply

We thank Dr. de Lotbinière for his interest in our article and for sharing his personal experience with both LINAC and gamma knife radiosurgery. We certainly agree with his conclusion that the gamma knife offers advantages over LINAC systems, especially for irregularly shaped targets such as acoustic neuromas. Fractionated stereotactic radiotherapy is appealing in theory, and the preliminary reports look promising, especially in terms of cranial nerve toxicity. But this technology must be considered experimental at the present time. We were aware of efforts by the neurosurgical team to obtain a gamma knife for the Montreal Neurological Institute many years ago. The inclusion of this historical vignette about these forward looking individuals is quite appropriate.

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