Third, they state that the cost of the gamma unit is at least $5 million to purchase and install. This figure is incorrect. They state that the cost of modifying a linear accelerator to deliver a focused radiation dose is between $50,000 and $100,000. That may be the cost that their group paid, but certainly most of the linear accelerator systems elsewhere in the world have cost much more than that, especially since many have developed their own treatment planning systems. They also state that operating costs are embedded in the cost of running the radiotherapy unit – in a provincial health care system, the government still pays the costs regardless of which departmental budget it may fall under. In fact in a ten year cost-estimate analysis developed by Epstein et al., Brown University, the cost of the Gamma Knife is *less* than that of a linear accelerator provided that the same number of patients are treated, when mechanical and personnel costs are considered (personal communication).

Fourth, they state some of the linear accelerator results for the treatment of AVM's and compare these to published results using the gamma unit. Their system is based on the linear accelerator system initially developed in Montreal, and the results for treatment of AVM's at that center have now been reported in the Canadian Journal of Neurological Sciences.[2] In the treatment of 36 patients, 27 had two year angiographic follow-up and only 11 (41%) were completely obliterated. This seems lower that the results reported at our institution[3,4,5] as well as by some other linear accelerator centers.

Finally, their statement that "it is certain that there will be very few gamma units because of their high cost and limited application" cannot be further from the truth. There are more than 10 gamma units now in the United States, and more than 30 across the world. The comment "there will not likely be sufficient cases to sustain even a few gamma units in North America" does not appear to be true because all centers seem to be quite busy. The average site treats 160 patients per year; more than 5,000 to date worldwide and more than 2,000 in 1991 alone (approximately 900 patients at the University of Pittsburgh since August 1987.) Their final comment that "any hospital or health system that is contemplating the acquisition of a gamma knife can expect to have a facility that is over-priced and underutilized" would be challenged by many of the socialized health care systems of European countries that have purchased gamma units (including Norway, Italy, Spain, France, Austria, Czechoslovakia and England). Many of the productive linear accelerator radiosurgery groups that we know and converse with, do not appear to be threatened by gamma unit radiosurgery, but rather seem to benefit from the scientific information we all share. We believe that in a peer review journal of such stature as The Canadian Journal of Neurological Sciences, in which we ourselves have published, that a "review" article should review, not editorialize with unsubstantiated comments.

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2. McKenzie MR, Souhami L, Padgorsake E, et al. Photon radiosurgery: A clinical review. Can J Neurol Sci 1992; 19: 212-221.
3. Lunsford LD, Kondziolka D, Flickinger JC, et al. Stereotactic radiosurgery for arteriovenous malformations of the brain. J Neurosurg 1991; 75: 512-524.
4. Colombo F, Bendetti A, Pozza F, et al. Linear accelerator radiosurgery of cerebral arteriovenous malformations. Neurosurgery 1989; 24: 833-840.
5. Betti OO, Munari C, Rosler R. Stereotactic radiosurgery with the linear accelerator: Treatment of arteriovenous malformations. Neurosurgery 1989; 24: 311-321.

REPLY

To the Editor:

We are responding to the Letter to the Editor written by Drs. Douglas Kondziolka and Dade Lunsford of the University of Pittsburgh, in response to our article entitled, "Current status of radiosurgery for arteriovenous malformations", published in the Canadian Journal of Neurological Sciences, 18: 499-502, 1991.

First, we wish to reassure Drs. Kondziolka and Lunsford that we do not feel threatened by Gamma Knife technology.

We are concerned, however, that Drs. Kondziolka and Lunsford may have left readers with the mistaken impression that we deliver radiosurgical treatments using a linac based system on which a 4 mm discrepancy between the mechanical and radiation isocentres has been demonstrated. No patients have been treated on that unit. Woo[1] has provided a salutary warning against the indiscriminate use of linear accelerators which have not been adequately commissioned for the purpose of radiosurgery. The specifications of the linear accelerator system presently delivering radiosurgery at the Toronto-Bayview Regional Cancer Centre have been published elsewhere[2] and in our view, they match the capabilities of the Gamma Knife.

As far as costing is concerned, we would be pleased to learn Drs. Kondziolka and Lunsford's estimates for the purchase and installation of a Gamma Knife. We believe the cost advantage for a linear accelerator system will only be realized through the modification of existing equipment as discussed in our article rather than with the acquisition of a unit dedicated to radiosurgery.

Our group has always been pleased to share information through the medical and scientific literature. The benefit derived will in part depend on the care with which it is read.

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Peter O'Brien
Phillip Davey
Charlene Young
Robert Willinsky
Charles Catton
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Brain Vascular Malformation Study Group

1. Woo MK, O'Brien P, Gillies B, et al. Mechanical and radiation isocenter coincidence: An experience in linear accelerator alignment. Med Phys 1992; 19: 357-359.
2. O'Brien PF, Gillies BA, Schwartz M, Young C, Davey P. Radiosurgery with unflattened 6-MV photon beams. Medical Physics May/June 1991; 18(3): 519-521.