

## Letter: The Zap-X Radiosurgical System in the Treatment of Intracranial Tumors: A Technical Case Report

To the Editor:

We read with great interest the recent article by Pan et al<sup>1</sup> about newly designed surgical robot for brain and head and neck radiosurgery, the Zap-X system (Zap Surgical Systems Inc, San Carlos, California). There are described 2 patients treated with ZAP, the first harboring a trigeminal schwannoma and the second a petroclival meningioma, treated with a radiation dose of 13 Gy at the 50% isodose line. Both cases experienced tumor reduction and symptom improvement during follow-up course, in the absence of any complications.

As the authors state, this is a small series. However, the extremely novel technology, as well as such encouraging preliminary results, are of interest for the radioneurosurgical community and should be followed by other reports in due time. Several aspects caught our attention and would deserve further discussion.

The marginal dose prescribed is a standard one for trigeminal schwannomas<sup>2</sup> and in the range of what has been published for meningiomas.<sup>3</sup>

The prescription isodose line was 50%, which seems to be similar to what one would consider using a Gamma Knife (GK, Elekta Instruments AB, Stockholm, Sweden).

The illustration of the cases within the article, with the dose fall out outside the target volume, suggest a steep gradient and is extremely interesting as a concept and physical capacities of such device. Such might be related to what has been previously published, a combination of lower beam energy (3 MV), more solid angle gyroscopic crossfire but also the accuracy related to image-to-image x-ray correlation technology.<sup>4</sup>

The presence of structures at risk, in particular the brainstem, did not represent a problem per se in prescribing such optimal marginal doses, taking into account that the brainstem is suggested to support as high as between 12 and 15 Gy at the periphery, without a risk of complications within this area. Neuroimaging during follow-up showed no oedema or other radiation-induced changes. Nevertheless, it did suggest the presence of intralésional changes (necrosis) for the trigeminal schwannoma, which is in line with accurate radiosurgical dose delivered and associated benign tumor radiation-induced histological changes.

These clinical and radiological outcomes, as well as the technical capacities, would raise the question whether single fraction radiosurgery performed with the ZAP system would induce a similar radiobiological effect as to what is currently generated by other devices, including GK (Elekta Instruments AB) or CyberKnife.<sup>5-7</sup>

There are some technical aspects that we also wish to comment concerning the Zap-X technology. Some of the innovations appears revolutionary and promise to enhance the role of radiosurgery in neurosurgical practice while keeping this technique close to the culture and moral principles of *Neurosurgery*. The Zap-X maintains a robotic approach to dose delivery and image-guidance (frameless radiosurgery) but with a simplified approach (ie, the gyroscope instead of a robotic arm and a streamlined cranial radiosurgery-centric planning and delivery without the complexity of multipurpose radiotherapy delivery systems). Innovative online dosimetry provides automated stop if dose deviations occur during delivery. The system is self-shielded, namely a vault is not necessary, and the device can be installed anywhere, possibly complementing a neurosurgical operative compound. The overall costs of the system promise to make radiosurgery more affordable in a world with less economic resources destined to neurosurgery.



We congratulate the efforts of Dr Adler's team. We salute the pioneering role of such personality and of what Dr Adler brought to our community.

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### Disclosures

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