Stereotactic radiosurgery: a meta-analysis of current therapeutic applications in neuro-oncologic disease
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CRD summary
This review concluded that data showed excellent results for stereotactic radiosurgery in treating several neuro-oncologic pathologies, but that there was a clear need and opportunity for future well-designed clinical trials in specific diseases. The call for further trials appears justified, but limitations in the evidence make the reliability of the conclusion about outcomes unclear.

Authors' objectives
To conduct a quantitative meta-analysis of stereotactic radiosurgery in neuro-oncology.

Searching
The PubMed database and Ovid search platform were searched up to November 2008 for relevant publications in English. Search terms were reported. Reference lists of retrieved studies were searched for further relevant evidence.

Study selection
It appeared that studies of stereotactic radiosurgery that reported pathology-appropriate outcomes were eligible for inclusion. Fractionated radiotherapy treatment regimens, case reports and studies that focused on population subgroups (such as only patients with neurofibromatosis II) were excluded from the review. To prevent double-counting of patients, if an institution published several similar articles only one would be eligible for inclusion unless clearly unique patient series were reported.

Selected studies included patients with vestibular schwannoma, glioblastoma multiforme, meningioma and intracranial metastases. Reported outcomes included stabilised disease, survival, non-neurological death and complications. Participants in the included studies varied widely in terms of tumour size, proportion with previous resection and dosage received.

Two reviewers independently selected studies for inclusion.

Assessment of study quality
The authors did not state that they assessed study quality.

Data extraction
The authors did not state how data were extracted from the included studies; some outcomes were extracted as proportions (such as stabilised disease, complications, survival at one or two years) and others as continuous values (such as median survival). Efforts were made to contact authors where outcome data were lacking.

Methods of synthesis
For certain outcomes, a random-effects model was used to calculate overall rates and associated 95% confidence intervals (CIs). The authors stated that statistical heterogeneity was assessed, but did not state the method used. Studies were grouped by disease.

Publication bias was assessed using Egger's test and adjustments made using Duval and Tweedie's trim-and-fill method.

Results of the review
Length of follow-up varied widely between the included studies. All values reported here were adjusted for publication bias where it was observed.

Vestibular schwannoma: There were 37 case series (3,677 patients). Rate of stabilised disease was 91.1% (95% CI 89.1 to 92.8). Rate of non-cranial nerve complications was 5.6% (95% CI 4.2 to 7.6). Overall rate of serviceable hearing
preservation was 59.3% (95% CI 51.9 to 66.4). Rate of new facial palsy was 7.1% (95% CI 4.1 to 10.4). Rate of improvement in tinnitus was 17.1% (95% CI 10.8 to 26.0). Rate of surgical resection was 3.7% (95% CI 2.7 to 5.3).

**Glioblastoma multiforme**: There were nine case series, one case control study and one randomised controlled trial (456 patients). Median survival from diagnosis ranged from 13.5 to 26 months for stereotactic radiosurgery compared with 13 to 23 months for comparison groups. Overall complication rate was 11.4% (95% CI 5.1 to 23.6).

**Meningioma**: There were 15 case series (2,734 patients). Rate of stabilised disease was 89% (95% CI 86.4 to 92.3). Rate of complications was 7% (95% CI 5.3 to 9.3).

**Intracranial metastatic disease**: There were 25 case series and two randomised controlled trials (2,679 patients). Overall median survival from time of stereotactic radiosurgery was five to 14 months. One-year survival rates ranged from 15% to 54.9%. Local disease control rates range from 59.6% to 96.8%. Overall complication rate was 10% (95% CI 6.4 to 15.3).

**Authors' conclusions**
While there is a pathology-specific role for stereotactic radiosurgery, data show excellent results in treating several pathologies. Clearly there is a need and an opportunity for future well-designed clinical trials to evaluate stereotactic radiosurgery for specific neuro-oncologic diseases.

**CRD commentary**
This review addressed a broadly defined research question. Attempts were made to find relevant literature, but unpublished evidence and evidence in languages other than English were likely to have been missed. Attempts were made to limit potential for errors and bias during study selection, but not elsewhere in the review process. Other aspects of the research process were not clearly reported. Most of the included evidence came from case series and this type of study does not include any comparison group and is prone to the effects of confounding; this issue was alluded to but no formal assessment of study quality was conducted.

The author's conclusion that further well-designed trials are needed appears to be justified. The conclusion about stereotactic radiosurgery outcomes appears to follow from the presented evidence, but limitations in the evidence make the reliability of this conclusion unclear.

**Implications of the review for practice and research**
The authors did not state any implications for practice.

**Research**: The authors stated that more rigorous controlled studies will be needed to more clearly elucidate size parameters for the treatment of meningiomas and that all future studies of intracranial disease should report pathology-specific outcomes.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.