Conservative management, gamma-knife radiosurgery, and microsurgery for acoustic neurinomas: a systematic review of outcome and risk of three therapeutic options

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CRD summary
This review evaluated the efficacy and risks of three therapeutic options for acoustic neurinomas. It demonstrated that with conservative management and radiologic follow-up the majority of acoustic neurinomas are slow growing but eventually require intervention. Gamma-knife radiosurgery and microsurgery provide tumour control. The analysis was simplistic, and the authors’ conclusions about the superior efficacy of microsurgery needs to be interpreted with caution.

Authors’ objectives
To evaluate the efficacy and risks of three therapeutic options for acoustic neurinomas: conservative management with radiologic follow-up; gamma-knife (GK) radiosurgery; and microsurgery.

Searching
MEDLINE was searched from 1993 to January 2003 (the dates varied according to therapeutic indication); the search terms were reported. Original articles were also checked for further references.

Study selection
Study designs of evaluations included in the review
Studies of any design appeared to be eligible for inclusion. Other criteria were applied according to the therapeutic option: for conservative management with radiologic follow-up, studies had to have included a minimum of 20 patients and followed up participants for a mean period of at least 2 years; trials of GK radiosurgery and trials of microsurgery had to have included at least 100 patients. The mean follow-up periods were 3.1 years and 3.8 years for conservative management and GK radiosurgery, respectively; it ranged from 0.25 to 17 years for microsurgery.

Specific interventions included in the review
Studies of GK radiosurgery, microsurgery, and conservative management with radiologic follow-up were eligible for the review. The included studies of conservative management employed magnetic resonance imaging and/or computed tomography for radiologic follow-up. The included studies of GK radiosurgery used maximum doses of 15 to 53 Gy and marginal doses of 9 to 20 Gy.

Participants included in the review
Studies of patients with sporadic unilateral acoustic neurinomas were eligible for the review. Studies that contained none or only a limited number of neurofibromatosis 2 (NF2) diagnoses were not excluded. Studies of conservative management in participants with recurrent or previously treated tumours were excluded. Specifically for the review of microsurgery, trials had to have a definition of the patient population.

The mean age of the patients in the included studies ranged from 46 to 75 years (overall range: 10 to 94). The size of tumour at presentation was expressed differently for the three therapeutic options: in studies of conservative management with radiologic follow-up the mean size ranged from 4.9 to 16 mm; in studies of GK radiosurgery the mean tumour volume, where measured, was 2.7 mL; and in studies of microsurgery the proportion of patients with large tumours ranged from 0 to 42%. Other therapy-specific demographic details were tabulated in the review. Trials of microsurgery were excluded if their populations were exclusively of patients with tumours larger than 3 cm.

Outcomes assessed in the review
Outcomes were not specified as inclusion criteria for the review. The outcomes reported from the included studies were: change in tumour size; the proportion of patients who required intervention (after study intervention); tumour growth rate; patients who underwent microsurgery after GK radiosurgery; hearing preservation rate (Gardner-Robertson...
or equivalent scale); tumour recurrence; facial function (House-Black scale); and complications (facial palsy, trigeminal neuropathy, hydrocephalus, mortality, major disability, cerebrospinal fluid leak).

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

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

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. The outcomes extracted varied with the therapeutic options.

Methods of synthesis
How were the studies combined?
The review employed a narrative synthesis that combined separately the study findings for each therapeutic option. Simple proportions, based on the total population, were calculated for some outcomes within each therapeutic option. No weighted analysis was used. Some findings for common outcome measures, reported for the different therapeutic options, were compared statistically using a chi-squared test. No details of the methods used were reported.

How were differences between studies investigated?
Details of the studies were tabulated and discussed in the text.

Results of the review
The review included 38 studies (n=7,383), but details of the study design were not reported. No study appeared to have a control group. There were 13 studies (n=903) of conservative management with radiologic follow-up, 9 studies (n=1,475) of GK radiosurgery and 16 studies (n=5,005) of microsurgery.

Conservative management and radiologic follow-up (13 studies): the mean tumour growth was 1.87 mm/year (range: 0.35 to 3.22). Twenty per cent of the patients ultimately required intervention (microsurgery); the mean follow-up before intervention was 2.1 years (range: 0.4 to 6.2). Hearing change was assessed in 3 studies (n=108). The mean pure-tone average deteriorated from 44.5 dB to 58.4 dB, and useful hearing was lost in 22 out of 60 patients.

GK radiosurgery (9 studies): 56% of tumours regressed and 8% grew. Of 689 patients, 4.6% ultimately required microsurgery. Useful hearing after GK radiosurgery was preserved in 57% of the patients. Complications reported after radiosurgery were facial palsy (8%), trigeminal neuropathy (8%) and hydrocephalus (3%).

A comparison of conservative management with GK radiosurgery found statistically lower rates of regression and higher rates of microsurgery postintervention.

Microsurgery: the tumour was totally removed for 96% of patients; the tumour recurrence rate was 1.8%. Useful hearing was preserved in 36% of the patients. Other results reported were: measurable hearing preserved in 47%; good facial function 87%; mortality rate 0.63%; major disability 2.9%; cerebrospinal fluid leak 6.0%.

The authors also reported the results from a subgroup analysis of microsurgery in patients with small-to-medium acoustic neurinomas.

Authors’ conclusions
The review of conservative management demonstrated that the majority of acoustic neurinomas are slow growing but do eventually require intervention. Whilst GK radiosurgery provides good tumour control, microsurgery provides the best treatment, although mortality and morbidity are not eliminated.
The inclusion criteria for this review of three therapeutic options for acoustic neurinomas were not well defined, and differed between the options such that the level of evidence was not necessarily consistent. The search involved only a single database and further efforts to identify studies appeared limited; thus the possibility of missed studies is high. The reporting of the review’s methods and results left many aspects unclear. In particular, no information on the study designs was reported.

The authors made only limited attempts to standardise information across the therapeutic options when presenting their results, making comparisons across options difficult. Where comparisons were made, it is uncertain whether they were valid because of the lack of information about the study populations. The summarising and analysis of the available data was simplistic. The authors’ conclusions regarding the outcome of conservative and GK treatment are supported by the review’s findings, but their statement about the superior efficacy of microsurgery needs to be interpreted with caution.

Implications of the review for practice and research
Practice: The authors stated that both GK radiosurgery and microsurgery provide good tumour control. In addition, they highlighted the need for a uniform system of tumour measurement to enable the comparison of therapies.

Research: The authors stated that research into the long-term effectiveness of radiosurgery is required.

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