A prospective cost-effectiveness study of trigeminal neuralgia surgery
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The authors assessed microvascular decompression (MVD), glycerol rhizotomy (PRGR) and stereotactic radiosurgery (SR) in the treatment of patients with idiopathic trigeminal neuralgia. SR was performed with the Gamma Knife (Elekta Instruments, Norcross), using a mean radiation dose of 83.5 Gy (range: 70 - 90).

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised patients with idiopathic trigeminal neuralgia. Patients were included if they underwent surgery for idiopathic trigeminal neuralgia by the senior author during the dates of the trial.

Setting
The setting was a tertiary referral clinic. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness and resource use data were collected between July 1999 and December 2001. The price year was 2000.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was carried out prospectively on the same sample of patients as that used in the effectiveness study.

Study sample
The study sample comprised patients treated in the study setting during the study period. Six patients were not included because of insufficient follow-up data. There was no report that power calculations were carried out to estimate the impact of chance on the results. A total of 126 patients underwent 153 separate operations (33 MVD, 51 PRGR and 69 SR).

Study design
The authors designed a non-randomised controlled trial to assess the effectiveness of the three technologies. The authors decided upon which group to assign a patient to, based on the patient's age, medical condition, surgical history, severity of pain and patient preferences. The study was based at a single centre. The intended length of follow-up was not reported. The mean actual length of follow-up was 20.6 months. Excluding 41 patients who under went later operations at 10.9 months, and 4 patients who died at 6, 12, 15 and 17 months, the mean follow-up for the remaining 112 patients was 24.3 months.

Analysis of effectiveness
The authors reported that further details of the techniques had been published elsewhere (Lunsford et al. for PRGR, Pollock et al. for SR, and McLaughlin et al. for MVD, see (Other Publications of Related Interest) below for bibliographical details). The primary health outcome was facial pain. This was described as excellent (absence of facial pain without medication), good (complete pain relief but requiring low-dose medication), fair (continued pain but reduced more than 50% in comparison with before surgery) and poor.

The groups were compared in terms of their age, gender, side and duration of pain, prior surgery, prior MVD, trigeminal deficit and atypical features at analysis. The authors noted several statistical differences. Patients having PRGR were older than those having MVD, (p<0.01), and those having SR, (p<0.05). Fewer patients in the PRGR group had undergone prior surgery compared with the SR group, (p<0.05). The PRGR group underwent fewer operations compared with the MVD and SR groups, (p<0.01). No adjustments for these confounding factors were noted.

Effectiveness results
Immediate facial pain outcomes for MVD were excellent (n= 30, 91%), good (n=1, 3%) and fair (n=2, 6%). Recurrent pain was present in 6 patients (18%). Four patients (12%) underwent additional surgery.

Immediate facial pain outcomes for PRGR were excellent (n=35, 68%), good (n=5, 10%), fair (n=4, 8% and poor (n=7, 11%). Recurrent pain was present in 11 patients (20%). Eighteen patients (35%) underwent additional surgery.

Immediate facial pain outcomes for SR were excellent (n=45, 65%), good (n=5, 7%), fair (n=9, 13%) and poor (n=10, 15%). Recurrent pain was present in 8 patients (12%). Nineteen patients (28%) underwent additional surgery.

The authors reported that patients having MVD more commonly achieved and maintained an excellent outcome compared with PRGR, (p=0.01), and SR, (p<0.01). No difference was detected between PRGR and SR, (p=0.61).

Clinical conclusions
The authors did not draw clinical conclusions independently of the cost conclusions, though the clinical superiority of MVD was well demonstrated.

Measure of benefits used in the economic analysis
Quality-adjusted pain-free years (QAPFYs) were used as the summary measure of outcome. The authors estimated this measure by multiplying the length of follow-up and quality of facial pain adjustment (1.0 for excellent, 0.7 for good, 0.5 for fair and 0.1 for poor).

Direct costs
The authors did not report the perspective from which the cost analysis was carried out. The analysis focused on the cost per uncomplicated procedure, morbidity costs and costs of additional surgery. The costs were estimated from the administrative decision support system (Eclipsys Corporation, Boca Raton) at the authors' centre. This software estimates the cost for each encounter, taking physician costs and hospital-based expenses into consideration. The costs of continuing medication were excluded from the analysis because of the wide range of drugs taken and their relatively small value in comparison with the costs of surgery. The authors reported that discounting was not carried out due to the short timeframe. However, follow-up actually extended for the length of the clinical trial (average 20.6 months). All
costings beyond the first 12 months should have been discounted at an appropriate rate. The costs were adjusted to 2000 prices using the medical care component of the Consumer Price Index. The costs and the quantities were not reported separately.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
The indirect costs were not estimated. Given the age range of the patients involved, some might have been retired and thus no longer economically productive, the decision not to include the indirect costs would be justified.

**Currency**
US dollars ($).

**Sensitivity analysis**
Threshold analyses were carried out to estimate the amount of change required in key variables in order to equate the cost-effectiveness of the two least cost-effective technologies with the most cost-effective technology.

**Estimated benefits used in the economic analysis**
The average number of QAPFYs was 1.87 for MVD, 1.18 for PRGR and 1.48 for SR.

**Cost results**
The uncomplicated procedure cost was $13,403 for MVD, $4,680 for PRGR and $9,857 for SR.

The average morbidity cost was $1,026 for MVD, $59 for PRGR and $0 for SR.

The average additional surgery cost was $857 for MVD, $2,744 for PRGR and $2,381 for SR.

The total procedure cost was $15,286 for MVD, $7,483 for PRGR and $12,238 for SR.

**Synthesis of costs and benefits**
The cost per QAPFY was $8,174 for MVD, $6,342 for PRGR and $8,269 for SR.

The authors reported that reducing the cost of morbidity and additional surgeries to zero would not make either MVD or SR as cost-effective as PRGR. If the cost of additional surgeries after PRGR increased by 79% and 83% then MVD and SR, respectively, would be as cost-effective as PRGR.

**Authors' conclusions**
The general neurosurgical approach was "economically sound" in the study population. Older patients were reported to benefit from percutaneous surgeries providing pain relief at the lowest cost per quality-adjusted pain-free year (QAPFY), and microvascular decompression (MVD) was predicted to be more cost-effective at longer follow-up intervals.

**CRD COMMENTARY - Selection of comparators**
The authors compared MVD, PRGR and SR as treatments for facial neuralgia. The authors discussed the relative merits of several potential treatments and reported factors relevant to the decision on which treatment to use for a given
patient. The three technologies chosen for comparison were selected on account of them being commonly performed surgeries. You should decide if these represent valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**

The authors designed a non-randomised controlled trial. The use of three technologies enables comparisons to ascertain the true benefits of each technology and to address the clinical question posed. The internal validity of the study would have been improved if the study had been randomised, as this would have helped reduce systematic biases between the study groups. The authors observed several statistical differences between the groups, but made no attempts to control for such differences. The study sample was representative of the study population, enabling the conclusions to be applied to the broader study population. Appropriate statistical analyses were carried out to help establish clinical effectiveness.

**Validity of estimate of measure of benefit**

The authors estimated QAPFYs as their summary measure of benefits. Utility values were used in these estimates, but the source of the utility values was not reported. The values were not reported to have been estimated by a panel of experts, derived from a review of the literature, or obtained from patient questionnaires. Validating these utility values would improve the quality of the results presented. The use of QAPFYs as a summary measure enables broad comparisons to be made with both related and unrelated technologies.

**Validity of estimate of costs**

The perspective from which the cost analysis was carried out was not reported. Therefore, it was not possible to assess whether all the relevant costs were incorporated. Nevertheless, from the costs estimated, it appears that the perspective of the health care provider (clinic) has been adopted. There was a useful report of the sources of the costs included. The authors might have improved the analysis by reporting the unit costs and the quantities separately, and by using a statistical analysis to assess whether differences in the costs were significantly different. The sensitivity analysis, however, was useful to give an understanding of the robustness of the results to changes in key variables. Discounting was not carried out and some justification for this decision was reported. However, the costs incurred after the first 12 months of the study should have been discounted, despite the fact that the authors anticipated little impact on the results.

**Other issues**

The authors discussed the results of other studies and highlighted how their own work compared to and complemented the existing literature. The results were presented thoroughly, including details of the sensitivity analyses. The authors discussed several limitations and the resulting implications for the generalisability of the study. Such limitations included the non-randomised nature of the study, the exclusion of indirect costs, and the use of a tertiary care centre. In addition, the use of institution-specific costing data might impose further limitations on the ability to apply the results more broadly.

**Implications of the study**

The authors recommended that MVD "should be considered the preferred option for patients if their risk for general anaesthesia is acceptable". They stated that there is a need for more data to assess the role that radiosurgery should play in the treatment of patients with trigeminal neuralgia.

**Source of funding**

None stated.

**Bibliographic details**

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Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Cost-Benefit Analysis; Decompression, Surgical /economics; Female; Follow-Up Studies; Glycerol /administration & dosage /economics; Health Care Costs /statistics & numerical data; Humans; Male; Middle Aged; Prospective Studies; Quality-Adjusted Life Years; Radiosurgery /economics; Rhizotomy /economics /methods; Treatment Outcome; Trigeminal Neuralgia /economics /surgery

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