A cost-effectiveness analysis of endoscopic third ventriculostomy

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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 use of endoscopic third ventriculostomy (ETV) and cerebrospinal fluid shunt (CSF) placement in the treatment of paediatric hydrocephalus.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis and cost-utility analysis.

Study population
The study population consisted of children with hydrocephalus.

Setting
The setting was secondary care. The economic analysis was conducted in Canada.

Dates to which data relate
The effectiveness and resource data were gathered between 1989 and 1998. The prices related to year 2000.

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

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same group as that used in the effectiveness study.

Study sample
Power calculations to determine the sample size were not reported. Eligible children were identified from the British Columbia Children’s Hospital between 1989 and 1998. All patients (n=28) who underwent ETV were included in the study (intervention group). Those children were then matched for age, pathogenesis and the number of prior shunt procedures with patients treated with CFS (control group).

Study design
This was a retrospective cohort study that was conducted in a single centre. The median duration of follow-up was 35 months.
Analysis of effectiveness
All the patients entered in the study were included in the analysis. The primary health outcomes were the procedural success rates (defined by the avoidance of reoperation). The secondary health outcomes were the rate of treatment complications and deaths. The patients in the two groups were comparable for the matched factors. However, most of the shunt patients were treated before (in the 1980s) the patients in the intervention group.

Effectiveness results
The success rate was 54% (13 out of 28) among the ETV patients.

Ten of 13 ETV failures occurred within 6 months.

One hydrocephalus-related death and one hemiparesis occurred in the ETV group.

No permanent procedure-related morbidity or mortality was seen in the control group.

Clinical conclusions
ETV was not significantly more effective than CFS over a median of 35 months' follow-up.

Measure of benefits used in the economic analysis
The measures of health benefit were the number of days free of the hydrocephalus treatment and the quality-adjusted life-years (QALYs). A QALY weight was arbitrarily assigned to the days in the follow-up period. More specifically, 1 for day free of hydrocephalus treatment, 0.8 for day with hemiparesis, 0.2 for day hospitalised or in 14-day recovery period, and 0.0 for death. The benefits were discounted at a rate of 5%.

Direct costs
The perspective of the third-party payer was adopted. The direct costs included were those of the hospital and physician fees. The hospital costs were for antibiotics, neurosurgical consultation, operative costs, hardware costs, radiology costs, laboratory costs and hospital day costs. The unit costs for hospital resources were drawn from several sources, such as the British Columbia Children’s Hospital Health Service Study Unit and the University of Michigan Health care system's clinical information and decision support service. Professional fees were taken from both the Canadian published fees schedule for the Medical Services Commission and similar private fee schedules from the USA. A range of costs was, therefore, developed (low and high estimates). For the Canadian series, the costs for head computed tomography scans and magnetic resonance imaging studies were calculated as a capital cost plus labour and nonlabour costs. The hospital costs were based on yearly expenses. Actual charges were used for hardware costs. For the USA data, the TSI Costing System (Transition Systems Inc.) combined both the fixed and variable costs as well as the direct and indirect costs. The resource quantities and the costs were reported separately. All the costs were based on the value at year 2000. The costs were discounted at a rate of 5%.

Statistical analysis of costs
Standard statistical tests (Student’s t-test) were carried out to test the statistical significance of differences in the cost estimates across the two groups.

Indirect Costs
No indirect costs were included in the analysis.

Currency
Canadian dollars (Can$).
**Sensitivity analysis**

One-way sensitivity analyses were performed on the discount rate (1 to 10%), costs (+/- 25%), post hospitalisation recovery period (+/- 7 days) and success rate (75%).

**Estimated benefits used in the economic analysis**

The ETV group enjoyed an additional 86 days free of the hydrocephalus treatment over the shunt group during the matched follow-up period. The difference was not statistically significant.

Using the QALY measure, the ETV treatment became less effective than the shunt group (73.9 versus 78.5 QALYs).

**Cost results**

The ETV group had a higher length of stay (LOS) (mean 4.8 +/- 6.0 days) than the shunt group (3.8 +/- 2.4 days). It also required more operative time (2:20 hours +/- 48 minutes versus 1:35 hours +/- 22 minutes) and underwent more reoperations (4 versus 1).

During the mean follow-up periods, the shunt group required more readmissions (22 versus 16) with a longer LOS (4.1 +/- 3.9 days versus 3.38 +/- 2.3 days), including a greater use of the intensive care unit (7 versus 1 day). However, these differences were not statistically significant.

When including all resources used, patients in the ETV group had lower mean costs (Can$10,570 +/- 7,628 to Can$17,464 +/- 12,533) than those in the shunt group (Can$10,922 +/- 8,722 to Can$18,459 +/- 14,017). However, these differences were not statistically significant.

**Synthesis of costs and benefits**

When the number of days free of the hydrocephalus treatment was used as the benefit measure, the ETV therapy was both slightly less expensive and more effective than shunt therapy. However, the difference was not statistically significant.

The average cost-effectiveness ratios per patient per day free of treatment of hydrocephalus were Can$11.00 to Can$18.00 for the ETV group and Can$11.40 to Can$18.17 for the shunt group.

The sensitivity analyses showed that the results were robust to variations in the parameters.

Using the QALY benefit measures, the incremental cost-effectiveness ratios of ETV treatment, compared with the CFS alternative, were $2,153 to $6,187 per additional QALY gained.

**Authors’ conclusions**

In this matched cohort, over a median follow-up of 35 months, endoscopic third ventriculostomy (ETV) was not significantly less costly or more effective at producing days free of hydrocephalus than shunt treatment.

**CRD COMMENTARY - Selection of comparators**

A justification was given for the comparator used. The CSF shunt was chosen because it represented the most commonly used technique in the treatment of hydrocephalus in the authors’ setting. You should consider whether this is a widely used technology in your own setting.

**Validity of estimate of measure of effectiveness**

The study design (retrospective cohort study) was not really appropriate for the study question. A prospective randomised controlled trial would have been more appropriate. There were some limitations in the study. First, although the children were comparable for matched factors, the shunts were used earlier in the course of the study and
ETVs were performed later. Second, due to the small sample size, a number of common complications with ETV were not considered in the study (e.g. basilar perforation, aneurysm formation and memory loss). Third, the authors acknowledged that the 35-month follow-up period was a small window of time in the life history of many of the children included in the study. These facts may hinder the relevance of the study.

Validity of estimate of measure of benefit

The authors derived utility weights for calculating QALYs using arbitrary values. Utility weights should be derived directly from patient preferences. This fact limits the validity of the benefit estimates.

Validity of estimate of costs

The costs and the quantities were reported separately. Both the unit costs and charges were used. The unit costs were derived from several sources from Canada or the USA. Some costs were modified while others were calculated. Some costs included a capital cost while others did not. These facts may hinder the understanding of the cost analysis and, subsequently, the reproducibility of the results to other settings. A statistical analysis of the costs and sensitivity analyses were performed. The authors did not justify the choice of a 5% common discount rate for both the costs and benefits.

Other issues

The generalisability of the results was not addressed. However, the authors made appropriate comparisons of their findings with those from other studies. The authors highlighted some, but not all, of the limitations of their study. They do not appear to have reported their results selectively.

Implications of the study

The authors recommended that a larger cohort with longer follow-up should be conducted to demonstrate the cost-effectiveness of this therapy more clearly. A written comment following the article (made by L N Sutton) stated "until the true indications for ETV are defined, this analysis must be considered preliminary, at best".

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