Pharmacoeconomic analysis of sevoflurane versus isoflurane anesthesia in elective ambulatory surgery

Wagner B K J, O'Hara D A

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
Sevoflurane, which, at the time of the study, was a recently approved inhalational anaesthetic agent, in women undergoing elective ambulatory surgery.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
American Society of Anesthesiologists (ASA) physical status I or II women undergoing elective ambulatory surgery.

Setting
Hospital. The economic analysis was carried out in the USA.

Dates to which data relate
Effectiveness and resource use data were derived from a randomized study conducted in 1993, whose results were published in 1996. The price year was 1993.

Source of effectiveness data
The evidence for the final outcomes was based on a single study.

Link between effectiveness and cost data
Costing was conducted on the same patient sample as that used in the effectiveness analysis and appears to have been performed prospectively.

Study sample
Power calculations were used to determine the sample size. Post hoc analysis revealed that approximately 100 patients/group would be required to show statistical significance with 80% power for all recovery durations. The 47 study patients were randomised to receive either sevoflurane (n=25, mean (SD) age 35.4 (1.3) years) or isoflurane (n=22, mean (SD) age 34.3 (1.2) years) with 60% nitrous oxide general anesthesia.

Study design
The study was a randomised, open-label, controlled trial, carried out in a single centre. The duration of the follow-up was until discharge. There was no loss to follow-up. Patient records were screened for completeness and accuracy of information, total dose of induction agent, anaesthetic, duration of surgery, anaesthesia, and recovery room stay, and postoperative drug requirements.

**Analysis of effectiveness**

The principle used in the analysis of effectiveness was treatment completers. The clinical outcomes were times to achieve recovery milestones and discharge times calculated based on actual readiness as determined by Aldrete score. The frequency of adverse events was also reported. The study groups were comparable in terms of baseline demographic and clinical characteristics.

**Effectiveness results**

Patients in the sevoflurane group experienced faster initial recovery and earlier discharge, but did not reach statistical significance. Although the sevoflurane group left stage II recovery more rapidly than the isoflurane group (121.2 (SD, 14.4) versus 175.2 (21.7) minutes, p=0.04), they stayed longer in stage I (124.6 (7.9) versus 106.8 (7.1) minutes, p=0.11), for a non-statistically significant difference in total recovery time (246 (15.1) versus 282 (23.6) minutes, p=0.21). No patient required narcotic reversal. Postoperative nausea was more than 50% in both groups, but women who received isoflurane experienced much more postoperative cough (32% versus 4%, p<0.01). A non-significant trend was toward more shivering in the sevoflurane group (40% versus 18%).

**Clinical conclusions**

Despite longer and deeper anesthesia, patients in the sevoflurane group awoke earlier in the recovery room. Therefore, the longer overall anesthesia time associated with sevoflurane cannot be due to the effects of the anesthetic itself. The study results also showed a trend toward shorter recovery room stay in the sevoflurane group by 36 minutes, although this did not achieve statistical significance.

**Measure of benefits used in the economic analysis**

No summary benefit measure was identified in the economic analysis, and only separate clinical outcomes were reported.

**Direct costs**

Costs were not discounted due to the short time frame of the cost analysis. Quantities were reported separately from the costs. Cost items were reported separately. The cost analysis covered the costs of operating room, recovery room, anesthesia, and medications. The perspective adopted in the cost analysis appears to have been that of the third-party payer. Charge data for most resource use were obtained from the departments of pharmacy and hospital accounting. Computer simulations of anaesthetic gas delivery and uptake were used to estimate the costs of inhalation anaesthesia. All drug costs were converted to charges using a 1:2 cost:charge ratio. The price year was 1993. The cost analysis did not cover the costs of surgeons' fees or laboratory and diagnostic tests.

**Statistical analysis of costs**

The Lilliefors test was used to assess normality of data. The t test and Mann-Whitney U tests were used by the authors in the statistical analysis of costs.

**Indirect Costs**

Not considered.

**Currency**

NHS Economic Evaluation Database (NHS EED)
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US dollars ($).

**Sensitivity analysis**
Not conducted.

**Estimated benefits used in the economic analysis**
Not applicable.

**Cost results**
The mean (SD) total charge for the isoflurane group was $2,230 (198) versus $2,641 (174) in the sevoflurane group, (p=0.12).

**Synthesis of costs and benefits**
Costs and benefits were not combined.

**Authors' conclusions**
Sevoflurane did not decrease charges over isoflurane despite insubstantially earlier discharge for patients receiving sevoflurane.

**CRD COMMENTARY - Selection of comparators**
The strategy of using isoflurane, a commonly used inhalational anesthetic, was regarded as the comparator. You, as a database user, should consider whether this is a widely used health technology in your own setting.

**Validity of estimate of measure of effectiveness**
The internal validity of the effectiveness results is likely to be high due to the randomised nature of the study design. However, the fact that the sample size was smaller than that required by the power analysis, and the fact that the effectiveness analysis was based on the principle of treatment completers may weaken the internal validity of the effectiveness analysis. Furthermore, the authors reported using thiopental induction and a standardised range for narcotics and midazolam (instead of using propofol induction), and adjustment to changes in the study practice (the study same-day surgery unit was reported to have opened just before the study and newer prophylactic antiemetics were not routinely used) as the potential confounders affecting the recovery time. The study groups were comparable in terms of baseline demographic and clinical data. The study sample appears to have been representative of the study population.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit and the study was, therefore, a cost-consequences analysis.

**Validity of estimate of costs**
The cost results are likely to be internally valid as the cost analysis was performed on the same patient sample used in the effectiveness analysis. Statistical analyses were performed on resource consumption and cost data to account for uncertainties. However, the authors did not report the perspective adopted in the economic analysis, which appears to have been that of the third-party payer. Some quantities were reported separately, while item costs were not given. Charges were used as a proxy for costs and the cost:charge ratio was reported. In addition, the price year was also specified. Given the details provided about the methods of cost analysis, the cost results may not be generalisable to other settings or countries.
Other issues
The authors' conclusions appear to be justified given uncertainties in the data. The issue of generalisability to other settings was not addressed although some comparisons were made with other studies. The issue of the representativeness of the study sample of the study population was not addressed in the authors' comments.

Implications of the study
Larger trials and assessment of other patients may show sevoflurane to be more pharmacoeconomically advantageous than isoflurane.

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