Cost analysis of remifentanil and fentanyl for neurosurgical anesthesia

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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
Use of remifentanil-nitrous oxide combination with low-dose isoflurane rescue in patients requiring craniotomy for supratentorial space-occupying lesions.

Type of intervention
Treatment; Anesthesia

Economic study type
Cost-effectiveness analysis.

Study population
Patients undergoing neurosurgery (craniotomy for supratentorial space-occupying lesions).

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

Dates to which data relate
The date(s) during which the effectiveness and resource use data were collected was not specified (the study was published in 1997). The fiscal year was 1996.

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

Link between effectiveness and cost data
Costing was retrospectively performed on the same patient sample as that used in the effectiveness analysis.

Study sample
Power calculations were used to determine the sample size: to detect a difference of 3 minutes in time to verbal command recovery between the study groups with a power of 80% and alpha equal to 0.05, a sample size of 30 per study group was required. The study sample consisted of 63 patients randomly assigned to receive the remifentanil hydrochloride (n=32) with a mean (SD) age of 51 (13) years or opioid fentanyl citrate (n=31) with a mean (SD) age of 49 (13) years.

Study design
Multicentre, double-blind, randomized, controlled trial, carried out in three centres. The duration of follow-up was 12
hours after completion of surgery. One patient from the fentanyl group was lost to follow-up. Investigators and staff were kept blinded to the contents of syringes.

**Analysis of effectiveness**

The principle used in the analysis of effectiveness was intention to treat. The clinical outcome measures were systolic blood pressure, intracranial pressure, cerebral perfusion pressure, isoflurane use, median time to tracheal extubation, the number of patients requiring naloxone, postoperative systolic pressure, and incidences of nausea and vomiting. The percentage reaching normal recovery score (based on an established two-part scoring system) along with recovery times of patients achieving a normal score within 60-minute emergence period were also reported. The patients were found comparable in terms of demographic and tumour characteristics.

**Effectiveness results**

The patients in the fentanyl group had a systolic blood pressure of 127 (SD, 23) mmHg versus 113 (18) mmHg in the remifentanil group, (p=0.004), between intubation and 5 minutes after intubation. The corresponding values in terms of intracranial pressure were 14 (13) mmHg and 13 (10) mmHg, (p=0.65). The cerebral perfusion pressure was 76 (19) mmHg in the fentanyl group versus 78 (14) mmHg in the remifentanil group, (p=0.71). The fentanyl group had greater isoflurane use compared with the remifentanil group. The fentanyl group had a median time to tracheal extubation of 4 (range: -1 to 40) minutes versus 5 (range: 1 - 15) minutes. The corresponding values in terms of the number of patients requiring naloxone were 7 and 0, respectively. The fentanyl group had a postoperative systolic pressure of 134 (16) mmHg versus 147 (15) mmHg in the remifentanil group, (p=0.001). The study groups had similar incidences of nausea and vomiting. The percentage of patients reaching normal recovery score within the 60 minute emergence period was 31% in the fentanyl group versus 16% in the remifentanil group, (p=0.15). The two study groups had similar results in terms of recovery times of patients achieving a normal score within the 60 minute emergence period.

**Clinical conclusions**

Remifentanil appears to be a reasonable alternative to fentanyl during elective supratentorial craniotomy.

**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 adopted for the study (24 hour time frame). Quantities were not reported separately from the costs. Cost items were reported separately. Cost analysis covered the costs of opioids (remifentanil or fentanyl), plasma-volume expanders, neuromuscular blocking and reversal agents, antiemetics, sedatives and hypnotics, cardiovascular agents and hypertensives, fluid and electrolyte balancing agents, and others including inhalational agents, analgesics, opioid-reversal agents, and antialagogues and anticholinergics. The perspective considered in the cost analysis was that of the hospital pharmacy administrator. The cost data were based on average wholesale prices (AWPs). 1996 price data were used. The cost analysis did not cover the costs of drugs used for routine prophylaxis and for treatment of pre-existing conditions. Furthermore, the costs related to recovery, complications, equipment, or drug waste were not covered due to lack of appropriate data.

**Indirect Costs**

Not considered.

**Currency**

US dollars ($).
Sensitivity analysis
A set of one-way sensitivity analyses was performed on the price of the opioids and prices of other drugs.

Estimated benefits used in the economic analysis
Not applicable.

Cost results
The average total anesthesia-related drug costs per patient, based on median price, were $424 in the remifentanil group versus $460 in the fentanyl group.

Synthesis of costs and benefits
Costs and benefits were not combined since the use of remifentanil was the dominant strategy.

Authors’ conclusions
In a retrospective cost analysis, anesthesia drug costs per patient were lower with remifentanil hydrochloride than with fentanyl citrate except when the lowest average wholesale price was assumed.

CRD COMMENTARY - Selection of comparators
A justification was given for the choice of the comparator. It was regarded as the commonly used health technology in the context in question. 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 benefit
The effectiveness results are likely to be internally valid given the use of a randomized double-blinded design and the fact that power calculations were used to determine the sample size. The study should be regarded as a cost-consequences analysis.

Validity of estimate of costs
Quantities of resource use were not reported separately from the costs, although, adequate details of the methods of cost estimation were given. The cost results may not be generalisable to other settings or countries.

Other issues
The authors’ conclusion seems to be justified given the uncertainties of the data, which were handled by a set of sensitivity analyses. Comparisons with other studies were not made.

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