Use of anesthesia selection in controlling surgery costs in an HMO Hospital

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
Two regimens used in intra-abdominal surgery for the induction and maintenance of anesthesia. The first regimen involved the use of propofol for induction and maintenance, while the second employed thiopental for induction and isoflurane for maintenance.

Type of intervention
Anaesthetic

Economic study type
Cost-effectiveness analysis.

Study population
The study population was patients undergoing elective intra-abdominal surgery. The surgery involved an open incision of the abdominal cavity requiring general anesthesia for up to four hours and patients' American Society of Anesthesiology physiologic status was 1 or 2. Both men and women took part in the study, with ages ranging from 18 to 70 years. However, most (88.5%) of the patients were women of middle age (mean, 43.75 years). The following patients were excluded from the study: pregnant or lactating women; patients with a clinically significant history of cardiovascular, respiratory, endocrine, or neurologic disorders, and those with severe hepatic or renal insufficiency; patients with psychiatric and other mental disorders that hindered effective communication with investigators; patients with a history of allergies to propofol, barbiturates, or other medications commonly used in general anesthesia; patients who received concurrent spinal, epidural, or regional anesthesia; patients who were health care professionals; and patients who were undergoing laparoscopy or who had participated in any other drug trials in the preceding 31 days.

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

Dates to which data relate
Dates were not given.

Source of effectiveness data
Single study.

Link between effectiveness and cost data
Costing was undertaken on the same patient sample as that used in the effectiveness study. Costing was carried out on a prospective basis.
Study sample
Patients who underwent elective intra-abdominal surgery were eligible to participate. Patients were randomised to one of the two drug regimens. 63 patients were entered into the trial, with 52 considered to be assessable (23 in the propofol arm and 29 in the thiopental/isoflurane arm) and 11 found to be ineligible due to cancellation of surgery, an exclusion criterion met after randomisation, or a protocol violation. No power calculations were provided, and there was no mention that the sample size may be insufficient. The authors accepted that only a narrow spectrum of patients were selected but they justified this by arguing that their objective was to analyse a realistic cross-section of cases as they are presented in a typical operation. Thus, they did not attempt to limit enrolment based on sex or diagnosis.

Study design
The study was an open-label, randomised, multicentre, prospective, observational economic clinical trial. Data were acquired from university, community, and HMO hospitals, but only data from the HMO hospitals were reported in this study. Randomisation was carried out at the level of the patient.

Analysis of effectiveness
Analysis of the clinical study was based on intention to treat. The principal reported health outcomes were adverse events, incidence of vomiting, blood pressure, heart rate and respiratory rate. Various statistical methods revealed approximately normal distributions for outcome variables, while the patient distribution was homogeneous relative to age, body weight and height. To determine interaction between variables, a stratification to control for prognostic variables was used.

Effectiveness results
No statistically significant difference was found between groups in the mean proportion of time that a patient spent away from baseline assessment of vital signs (blood pressure, heart rate, respiratory rate), thus suggesting that both treatments were similar in efficacy. Although propofol patients used less antiemetic medication and reported fewer adverse events than thiopental/isoflurane patients, statistical significance for these differences was not reached. There was no significant difference in Aldrete scores.

Clinical conclusions
No statistically significant differences emerged from the clinical results, thus leading the authors to conclude that both treatments were similar in efficacy.

Measure of benefits used in the economic analysis
Since the effectiveness analysis showed no difference in effectiveness/clinical benefit between the two treatment regimens, the economic analysis was based on the difference in costs only.

Direct costs
The direct costs of induction and maintenance of anesthesia are taken from a clinical trial performed at an HMO hospital. As well as the cost of the anesthesia drugs, the analysis also included the cost of the clinical labour involved in administering the drug as well as the fixed costs associated with the facility. A full-resource cost-accounting model was used to track the total cost of surgery and total cost of anesthesia for inpatients. The model traced the total cost of inpatient surgery from time of patient admittance to discharge. The inpatient surgical procedure and resulting costs were separated into four major components: preoperative, operative, postoperative recovery room and ward. Within each of these cost components, there were variable costs (i.e. clinical labour, anesthesia, anesthesia-related pharmaceuticals, and other pharmaceuticals), direct fixed costs (i.e. operating room equipment, and recovery room equipment) and other fixed costs (i.e. general and administration costs). Resources used by each patient were collected and then linked to unit costs within the hospital. The differential economic impact of using one agent instead of another was computed by subtracting the cost estimates of one regimen from similar estimates from the other regimen. Estimations of costs and quantities were based on actual data.
Statistical analysis of costs
Mean and median values as well as standard errors for costs were reported. Comparisons were made using paired t-tests, with a two-tailed p value of less than 0.05 indicating statistical significance.

Currency
US dollars ($).

Sensitivity analysis
Both quantities and drug acquisition cost were subjected to sensitivity analysis. Confidence intervals were calculated for clinical rates. The method used for sensitivity analysis was not specified.

Estimated benefits used in the economic analysis
Not applicable.

Cost results
The propofol group had a higher mean acquisition cost ($49.26) compared with that of the thiopental/isoflurane group ($32.49). However, the propofol group demonstrated an overall lower mean cost of surgery per patient ($1,759.09 versus $1,961.80). The propofol group also demonstrated a lower mean cost associated with anesthesia delivery and recovery ($534.46 per patient versus $543.59 per patient for thiopental/isoflurane). These results can be directly attributed to the timesavings realised by the propofol group in both the operative and postoperative recovery room centres.

Synthesis of costs and benefits
Not applicable.

Authors' conclusions
Both treatments were similar in efficacy. The results from this study support the notion that drug acquisition costs alone do not represent an accurate assessment of total costs incurred in anesthesia administration. Despite its higher acquisition cost, propofol is a good investment, since the overall costs associated are, on average, $202.71 less than for a patient treated with thiopental/isoflurane. Sensitivity analysis maintained the robustness of the conclusions with respect to all major parameters.

CRD Commentary
Generally, this was a well-designed and comprehensive attempt to include all relevant costs/quantities. However, there are some limitations. As the authors themselves pointed out, the setting is very specific and the choice of patients very limited. The problem with the specific nature of the setting is outlined by the discrepancy between findings in the HMO hospital, and those from the community hospital or university hospital. This seemed to be primarily a result of the strong association between site and the amount of propofol used. As well as being limited in terms of variety of patients, there is no knowing whether the study population is sufficient in terms of sample size as no power calculations were provided. Further details of the methods used in the sensitivity analysis would also have been informative. Bias may have been introduced by only analysing treatment completers. No mention is made of why these drug regimens were chosen. Recognition of the problems associated with carrying out an economic analysis alongside randomised clinical trials would also have been helpful.

Implications of the study
The extension of analysis beyond simply looking at drug acquisition costs is useful. Due to the vast number of intra-
abdominal surgical procedures carried out each year, a potential saving of around $200 per patient by using propofol, rather than thiopental/isoﬂurane, is highly signiﬁcant. The research might usefully be extended to other settings, particularly in an UK hospital. Other patient groups also need to be assessed to test whether the ﬁndings are generalisable to a wider patient population. Finally, it would be useful to know whether research has been carried out using other drug regimens, or are these two treatment regimens regarded as being the most effective/cost-effective ones available.

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