Reducing the demand for admission to intensive care after major abdominal surgery by a change in anaesthetic practice and the use of remifentanil

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 remifentanil as part of anaesthesia for major abdominal surgery, combined with a specific care organisation. Anaesthesia was induced with an intravenous bolus dose of remifentanil (1 microg/kg) administered over 30 to 60 seconds. An infusion of remifentanil was then started at a rate of 0.5 microg/kg per minute. Patients aged over 65 years received half of these doses. The organisation was admission to a high dependency unit (HDU), the details of which were given. It was stated that if there was no free bed in the HDU, the patient would be admitted to the intensive care unit (ICU) and care provided as for the HDU.

Type of intervention
Other: anaesthetic.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients undergoing major abdominal surgery. Patients with severe cardiorespiratory disease were excluded. No further selection criteria were given.

Setting
The setting was a hospital. The economic study was carried out in Cambridge, UK.

Dates to which data relate
No dates were given.

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

Link between effectiveness and cost data
The resource data were obtained from the same hospital as the effectiveness data. It is clear that some of this data were obtained from the same patients.

Study sample
The study sample comprised three groups. The 'safety and efficacy group' comprised the first 16 patients. These were administered remifentanil and were cared for in the HDU. Their mean age was 59.9 (+/- 11.1) years. The 'remifentanil routine group' comprised 10 patients. These were administered the new anaesthetic and then cared for in the HDU, as a
routine intervention, after the encouraging results of the efficacy and safety study. The 'non-remifentanil group' comprised 16 patients who were treated with the conventional practice before the introduction of remifentanil and the HDU. Their charts were retrospectively reviewed.

To compare the studies, two patients from each of the remifentanil and non-remifentanil groups were chosen to match those in an original safety and efficacy study for age, gender and operation where possible. An observer, unaware of the anaesthetic technique or outcome, chose one of these. No baseline characteristics (including age, gender or operation) were given. Only the characteristics of the safety and efficacy study patients were shown. The degree of success of matching was not shown. Finally, a further comparison was made between 15 patients undergoing liver transplantation who were administered remifentanil and cared for in the HDU and 15 patients undergoing liver transplantation who were treated with the conventional treatment.

**Study design**
This was a three-cohort study with matched historical controls. The length of follow-up was until discharge to ward. There was no loss to follow-up.

**Analysis of effectiveness**
Since there was no loss to follow-up, the analysis was by intention to treat. The effectiveness measures were the time to extubation, the time spent in the ICU or HDU, and the number of cancelled surgical procedures. There was no statistical comparison to test for possible confounding or bias.

**Effectiveness results**
The results were presented as the mean value plus or minus (+/-) the standard deviation.

The time to extubation was 9.9 (+/- 28.9) minutes in the safety and efficacy group, 4 (+/- 10) minutes in the remifentanil routine group, and 612 (+/- 417) minutes in the non-remifentanil group. The difference was statistically significant, (p<0.0001), when comparing both the remifentanil routine group and the safety and efficacy group with the non-remifentanil group.

The time spent in the ICU was 21 (+/- 6) hours in the safety and efficacy group, 0 hours in the remifentanil routine group, and 19 (+/- 4.5) hours in the non-remifentanil group, (p not given).

The time spent in the HDU was 23 (+/- 2) hours in the safety and efficacy group, 20 (+/-2) hours in the remifentanil routine group, and 0 hours in the non-remifentanil group, (p not given).

There were no cancellations in the safety and efficacy group and the remifentanil routine group, but there were 6 in the non-remifentanil group.

**Clinical conclusions**
After the introduction of remifentanil and the HDU, there was a statistically significant reduction in the time to extubation. There was also a reduction in the time spent in the ICU or HDU and the number of cancellations.

**Measure of benefits used in the economic analysis**
There was no summary measure of benefit. Thus, this is a cost-consequences analysis.

**Direct costs**
The cost boundary was that of the hospital. The costs were broken down into drugs and hospital stay on the basis of "staffing costs, disposables, drugs, etc". It was not stated whether diagnostic support costs or overheads were included. The resource quantities of the drugs for anaesthesia, sedation and analgesia were taken from the chart and combined
Statistical analysis of costs
The costs were treated stochastically. Statistical tests of the differences also were conducted.

Indirect Costs
The indirect costs were not reported.

Currency
UK pounds sterling (£).

Sensitivity analysis
No sensitivity analysis was reported.

Estimated benefits used in the economic analysis
No summary measure of benefit was reported. See the 'Effectiveness Results' section.

Cost results
The total costs were presented as the mean value +/- the standard deviation. The total cost was 795.27 (+/-253.49) in the safety and efficacy group, 392.10 (+/-39.80) in the remifentanil routine group, and 808.71 (+/- 187.06) in the non-remifentanil group. The difference was statistically significant, (p <0.0001), when comparing the remifentanil routine group with the non-remifentanil group.

Synthesis of costs and benefits
Not applicable.

Authors' conclusions
The introduction of remifentanil resulted in significant reductions in the time to tracheal extubation and the costs. "The need for intensive care and therefore cancellation of surgery was reduced".

CRD COMMENTARY - Selection of comparators
From an institutional perspective, the most appropriate comparison is between the proposed intervention and the existing technology. In this case, the change had been made. However, the biggest problem was that, as the authors admit, there was an introduction of a new drug plus a change in organisation. The original drug regime was not reported. It was also unclear as to what extent the organisation reflected policy or was secondary to the effectiveness of the drug. You should assess which anaesthetic regime and organisational setting reflect the current practice in your own setting.

Validity of estimate of measure of effectiveness
Selection bias will have been reduced by matching the baseline characteristics of the patients, and by some blinding of the anaesthetic technique and outcome. However, neither the extent of the matching nor the baseline characteristics were reported. The effectiveness measures of time to extubation, time spent in the ICU or HDU, and the choice of ICU or HDU, are subject to possible confounding by policy. For example, HDU was not a choice before the introduction of remifentanil and after its introduction, and the clinicians policy on extubation time could have changed informally.
Since there was no long-term follow-up and no measure of health outcomes, the value of these measures is speculative. The number of cancellations was an attempt to account for the consequences in terms of other patients. Also, the period of observation was not given and there are likely to be many institutional confounders.

**Validity of estimate of measure of benefit**
There was no summary measure of benefit.

**Validity of estimate of costs**
Most of the categories relevant to a hospital perspective in the short-term seem to have been addressed. However, there were no data on the quantities and the unit costs, and the source of these data was unclear. Also, the authors wanted to measure the impact on cancellations but provided no cost data. The price year was not given, thus preventing accurate valuation. In addition, no sensitivity analysis was conducted to account for generalisability.

**Other issues**
Generally, the paper suffered from a lack of reporting of the cost results. There was a lack of information on the study sample and the technology, which seriously affected the authors' conclusions. The findings were compared with the results of other studies, but the issue of generalisability was not discussed.

**Implications of the study**
"The changes we describe allow major surgery to proceed in this hospital without the need to book an intensive care bed in advance, whilst providing the patient with a safe environment to be cared for after surgery. By reducing the need for an intensive care bed, the risk of counselling operation is small. This has important implications for patient management as well as ICU resources." These views should be taken with caution in the light of the methodological limitations described.

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