Cost analysis of fentanyl and remifentanil in coronary artery bypass graft surgery without cardiopulmonary bypass

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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 remifentanil and fentanyl, two opiates used during off-pump coronary artery bypass grafting (CABG) without pulmonary bypass, was examined.

Type of intervention
Anaesthesia.

Economic study type
Cost-effectiveness analysis.

Study population
The study sample comprised patients undergoing CABG without pulmonary bypass, who required anaesthesia with either remifentanil or fentanyl.

Setting
The setting was a hospital. The economic study was conducted at the Hartford Hospital in Hartford (CT), USA.

Dates to which data relate
The effectiveness and resource use data were gathered from September 1998 to August 1999. No price year was reported.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was conducted prospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
Power calculations to determine the sample size were not performed. A sample of 59 patients was identified by checking the admission book in the cardiac intensive unit of the study hospital on a daily basis. All 59 patients participated in the study. There were 20 patients in the fentanyl group and 39 in the remifentanil group. The mean age in the fentanyl group was 66.5 (+/- 11.9) years, and 30% of the patients were women. The mean age in the remifentanil group was 65.8 (+/- 12.7) years, and 35% were women.
Study design
This was a prospective cohort study that was carried out in a single centre. The patients were followed until discharge. No loss to follow-up was reported. Demographic, intra-operative and post-operative data were obtained by chart review.

Analysis of effectiveness
All patients included in the study were accounted for in the effectiveness analysis. The primary health outcomes estimated in the analysis were the number of patients extubated in the operating room, the TTE and the LOS. The study groups were shown to have been comparable at baseline in terms of their demographics and clinical conditions.

Effectiveness results
Three (15%) patients in the fentanyl group were extubated in the operating room, compared with 25 (64%) in the remifentanil group, (p<0.001). The TTE was 5.7 (+/- 5.7) hours in the fentanyl group and 3.2 (+/- 5.7) hours in the remifentanil group, (p=0.005).

The LOS was 8.3 (+/- 2.7) days in the fentanyl group and 7.3 (+/- 3.1) days in the remifentanil group, (p=0.272).

Clinical conclusions
The effectiveness analysis showed that remifentanil was more effective than fentanyl in terms of the TTE and the number of patients extubated in the operating room. The length of hospital stay was similar in both groups.

Measure of benefits used in the economic analysis
The health outcomes were left disaggregated and no summary benefit measure was used in the analysis. A cost-consequences analysis was therefore conducted.

Direct costs
No discounting was carried out as the time horizon of the study was short. The unit costs were not reported separately from the quantities of resources. The health service costs were included in the economic analysis. These were for the ward, operating room medical and surgical supplies, intensive care unit, cardiac catheterisation laboratory, laboratory, pharmacy, anaesthesia, intravenous therapy (including administration and catheter insertion), respiratory therapy, transfusion, emergency room, vascular laboratory, recovery room, electrocardiogram, pulmonary medicine, rehabilitation, nuclear medicine, and computed tomography scan. The cost/resource boundary adopted in the study was that of the hospital. The quantities of resources used were assessed during the effectiveness study from September 1998 to August 1999. The costs were estimated using the patients’ bills, and a cost-to-charge ratio was applied to derive the true costs of hospitalisation. These were not stated. No price year was reported.

Statistical analysis of costs
Standard statistical analyses of the costs were conducted to test the statistical significance of the results. As the distribution of costs was somewhat skewed, multivariate regression analysis was carried out to assess the impact of some variables. These variables included diabetes, myocardial infarction, off-pump coronary artery bypass surgery, remifentanil, postoperative atrial fibrillation, and patients extubated in the operating room.

Indirect Costs
The indirect costs were not included in the analysis.

Currency
US dollars ($).
Sensitivity analysis
No sensitivity analyses were performed.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The total costs were $15,616 (+/- 4,169) in the fentanyl group and $15,272 (+/- 5,556) in the remifentanil group, (p=0.81). The multivariate regression analysis showed that remifentanil was not a predictor of the costs. Also, only diabetes, myocardial infarction and the number of patients extubated in the operating room were associated with higher costs.

Synthesis of costs and benefits
Not relevant as a cost-consequences analysis was conducted.

Authors’ conclusions
Remifentanil was effective in improving the time to extubation (TTE) in the operating room. The length of hospitalisation and the costs were similar in comparison with fentanyl.

CRD COMMENTARY - Selection of comparators
The authors stated that fentanyl and remifentanil were selected as no head-to-head study had been published on the costs of the two anaesthetics. You should decide whether they are widely used anaesthetics in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used a prospective cohort study in which the two anaesthetics were compared. Statistical analyses showed that the study groups were comparable at baseline. However, the sample size was fairly small and power calculations were not performed. The study sample was representative of the study population. All of the patients included in the study were accounted for in the effectiveness analysis. No loss to follow-up was reported.

Validity of estimate of measure of benefit
No summary benefit measure was used in the economic analysis. The analysis was therefore categorised as a cost-consequences study.

Validity of estimate of costs
The perspective adopted in the study appears to have been that of the hospital, and all the relevant categories of costs were included. A detailed cost breakdown was reported, but the unit costs and the quantities of resources were not reported separately. A cost-to-charge ratio was applied to estimate the true costs of the interventions. No price year was reported, thus making reflation exercises in other settings difficult. The cost estimates were specific to the study setting. Statistical analyses were conducted on the total costs. The authors commented that the study was of insufficient power to detect a statistically significant difference in the costs.

Other issues
The authors compared their findings with those from other studies, but did not address the issue of the generalisability of the study results to other settings. The authors commented on some limitations of their analysis, such as the lack of power calculations to determine the appropriate sample size and the use of a cost-to-charge ratio to derive true costs. A sample of patients undergoing CABG without cardiopulmonary bypass was enrolled in the study, and this was reflected...
in the conclusions of the analysis.

**Implications of the study**
Remifentanil proved to be more effective than fentanyl without increasing the costs. This finding should be confirmed in future prospective randomised studies with sufficient power.

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