Cost-effectiveness of thoracic patient-controlled epidural analgesia using bupivacaine with fentanyl vs. bupivacaine with morphine after thoracotomy and upper abdominal surgery

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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 study compared two kinds of thoracic patient-controlled epidural analgesia (TPCEA), using bupivacaine with fentanyl (BF) or bupivacaine with morphine (BM). All the patients received balanced salt solution before the thoracic epidural catheter was placed at the thoracic level of 6 - 8 for thoracotomy and of 8 - 10 for upper abdominal surgery. All patients received general anaesthesia. No opioids were given intravenously during the preoperative and intraoperative period, except one dose of fentanyl (>/= 2 microg/kg) during the induction period. Intraoperative analgesia was provided by thoracic epidural analgesia, using intermittent injections of 0.25% bupivacaine. Thirty minutes to 1 hour before surgery had finished, an epidural loading dose, either morphine 2 mg or fentanyl 50 microg, diluted in preservative-free normal saline, was given through an epidural catheter. In the postoperative period, patients were instructed as to how they could control the amount of epidural analgesia. The epidural solution (contained in a 160-mL bag) comprised 0.0625% bupivacaine with fentanyl 3 microg/mL in group BF and 0.0625% bupivacaine with morphine 30 microg/mL in group BM. Forty-eight hours after extubation, the epidural catheter was removed and conventional pain management started.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients between 18 and 80 years old with ASA physical status 1 - 3, who were scheduled for thoracotomy or upper abdominal surgery at one hospital, were eligible for the study. Patients were excluded if they had a history of allergic reaction to bupivacaine, fentanyl or morphine. They were also excluded if they had a history or laboratory results suggesting coagulopathy, obstructive sleep apnoea, central neurological disease, chronic pain, skin or subcutaneous tissue infection at the epidural insertion site. Other exclusion criteria were emergent surgery, non-functioning epidural catheters, and an inability to report pain scores or use patient-controlled analgesia.

Setting
The setting was secondary care. The economic study was carried out in Bangkok, Thailand.

Dates to which data relate
The dates to which the effectiveness and resource evidence referred were not given. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.
Link between effectiveness and cost data
The same patients provided both the cost and the effectiveness data. The cost data were collected retrospectively.

Study sample
Power calculations were reported. Based on the observed incidence of pruritus, 5% with fentanyl and 30% with morphine, a total sample of 80 patients (40 in each group) would ensure an 80% power to detect statistically significant results. Ninety patients were initially enrolled in the study, of which 11 were excluded because the catheters did not operate successfully. Forty patients were allocated to the fentanyl group (BF) and 39 to the morphine group (BM). The mean age of the patients was 50.30 (+/- 12) years in the BF group and 47.12 (+/- 11.4) years in the BM group.

Study design
The study was a randomised controlled trial that was conducted in a single centre. The method of randomisation was not reported. The patients were followed up for 48 hours. The authors did not report any loss to follow-up. The observers were blinded to the type of narcotic used.

Analysis of effectiveness
The analysis was conducted on an intention to treat basis. The health outcomes assessed were:

- the occurrence and severity of side effects (nausea, vomiting and itching scores),
- pain at rest and during movement, and
- patient satisfaction.

These outcomes were measured at 6, 18, 24, 30, 42 and 48 hours after extubation. Pain was scored on a visual analogue pain scale ranging from 0 (no pain) to 100 (worst symptoms). The nausea and vomiting scale and the pruritus scale were similar (0 = no symptoms, 100 = worst symptoms). Overall satisfaction (0 = least satisfaction and 100 = maximum satisfaction) was measured at 24 and 48 hours. The amount of supplementary analgesia needed during the 24 hours after the epidural catheter was removed was also calculated, as was the number of patients requiring treatment for side effects. The groups were shown to be comparable at baseline in terms of their age, weight, height, type of surgery, anaesthetic time, surgical time and amount of 0.25% bupivacaine given during surgery.

Effectiveness results
Pain, nausea, vomiting and itching scores were mostly similar between the two groups. There was a slightly higher nausea and vomiting score in the BM group at 18 hours, (p=0.047) and at 42 hours, (p=0.02).

Satisfaction levels were also similar in the two groups.

In the BM group, 28.5% of the patients required supplementary analgesia after catheter removal, compared with 51.4% in the BF group (statistical significance not reported).

The number of patients requiring treatment for pruritus and nausea or vomiting at different frequencies were also similar in both groups.

Clinical conclusions
Both fentanyl and morphine produced similar results, in terms of pain control and incidence of side effects, for patients using TPCPEA during the 48 hours after thoracotomy or upper abdominal surgery. After 48 hours, patients who had taken fentanyl needed more supplementary analgesia than those who had taken morphine.

Measure of benefits used in the economic analysis

NHS Economic Evaluation Database (NHS EED)
Produced by the Centre for Reviews and Dissemination
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The authors did not use a summary measure of benefit in the economic analysis. As therapeutic equivalence was demonstrated in the effectiveness analysis, the study could be characterised as a cost-minimisation analysis.

**Direct costs**
Discounting was not carried out as the costs were incurred during less than 2 years (48 hours). The costs of medications used in controlling pain and side effects (epidural infusion, itching therapy, nausea/vomiting therapy) were included, but not the cost of labour time. The quantities and the costs were not analysed separately. The authors reported that both costs and charges were calculated. Although the source of the costs or prices was unclear, the costs appear to have been estimated on the basis of actual data obtained from the hospital. No price year was given.

**Statistical analysis of costs**
No statistical analysis of the costs was carried out.

**Indirect Costs**
No indirect costs were calculated.

**Currency**
Thai baht (THB).

**Sensitivity analysis**
No sensitivity analysis was carried out.

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

**Cost results**
The mean costs were THB 814.15 (standard deviation, SD=217.51) in the BF group and THB 470.64 (SD=160.54) in the BM group.

The costs of adverse effects, in relation to the side effects expected, were included.

**Synthesis of costs and benefits**
Not relevant as the study was, in effect, a cost-minimisation analysis.

**Authors' conclusions**
Thoracic patient-controlled epidural analgesia (TPCEA), using solutions of bupivacaine with fentanyl (BF) or bupivacaine with morphine (BM), resulted in similar pain relief and side effect profiles but with "higher charged cost of medication in group BF". Morphine would appear to be a more cost-effective option than fentanyl for TPCEA after thoracotomy or upper abdominal surgery.

**CRD COMMENTARY - Selection of comparators**
The choice of the two kinds of pain relief studied in this paper was justified by them both being commonly considered to be current practice in the authors' setting. You should decide if these strategies are relevant in your setting, or whether other comparators could have been relevant as well.
Validity of estimate of measure of effectiveness
The source of the effectiveness data was a single study. The study design, a randomised controlled trial, was appropriate for the study question. The study sample appears to have been representative of the study population. The patient groups were shown to be comparable at analysis. The length of the study and follow-up were reported. In addition, power calculations were conducted and the assessment was blinded. Thus, it appears that the analysis of effectiveness has been handled credibly.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit. The health benefits are therefore those associated with the effectiveness outcomes.

Validity of estimate of costs
From the cost perspective adopted (i.e. that of the hospital), it was unclear whether all the relevant costs had been included. For example, analgesia after the epidural catheter had been removed was not included. If it had been, then the cost-advantage shown by morphine would have been even larger. Labour costs were also not included, although it was unclear whether their inclusion would have affected the authors’ conclusions. The costs and the quantities were not reported separately, which will limit the generalisability of the authors’ results to other settings. The resource use quantities were taken from a single study, while the prices were taken from the authors’ setting. No statistical, sensitivity or any other kind of analysis of the quantities or prices was carried out. The price year was not reported, thus hindering any future reflation exercises. Since all the costs were incurred during less than one year, discounting was unnecessary and was therefore not performed.

Other issues
The authors made appropriate comparisons of their results with the findings from other studies. With one exception, the present study showed a similar incidence of side effects between groups, the findings were similar. The authors suggested the possibility of the effect of genetic difference, which requires further study. The issue of the generalisability of the effectiveness results, but not of the cost results, to other settings was addressed. The authors stated that the psychology of Asian patients with respect to pain might be different from those in other societies. The authors do not appear to have presented their results selectively and their conclusions reflected the scope of the analysis. The study involved adult patients undergoing thoracotomy or upper abdominal surgery and this was reflected in the authors’ conclusions. The authors did not report any limitations to their study.

Implications of the study
The authors did not make any explicit recommendations for changes in policy or practice. However, from the authors’ findings and conclusions, they would appear to recommend morphine for TPCEA after thoracotomy or upper abdominal surgery. The authors suggested that future studies should investigate the genetic difference in adult patients undergoing thoracotomy or upper abdominal surgery.

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