Cost-effectiveness of differing perioperative beta-blockade strategies in vascular surgery patients

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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 beta-blockade strategies in vascular surgery. The health technologies under examination were:

- no routine perioperative beta-blockers (1);
- preoperative oral bisoprolol for 7 days followed by perioperative intravenous metoprolol and oral bisoprolol based on preoperative titration (2);
- immediate preoperative atenolol with postoperative intravenous then oral atenolol (3);
- intraoperative esmolol and postoperative intravenous then oral atenolol (4); and
- intraoperative and 18 hours of postoperative esmolol then atenolol (5).

Type of intervention
Treatment and primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a cohort of 596 patients undergoing AAA surgery who were identified in the Medicare claims.

Setting
The setting was secondary care. The economic analysis was conducted in the USA.

Dates to which data relate
The effectiveness data were gathered from studies published between 1981 and 1999. The resource data were gathered from 5% standard analytic files for the calendar years 1998 to 1999. The price year was not stated.

Source of effectiveness data
The effectiveness data were derived from a review of the literature.

Modelling
The basis of the cost-effectiveness analysis was a decision analytic model, using DATA Professional. The time horizon was unclear.
Outcomes assessed in the review
The outcomes assessed were:
the probabilities of death and acute myocardial infarction (AMI), as derived from Medicare data; and
the relative risks (RRs) of death and AMI for each strategy, as derived from the literature.
The RR of each strategy was derived by calculating the percentage of patients who sustained the event in the treatment group compared with the percentage of patients who sustained the event in the placebo group from the clinical trial.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Not reported.

Criteria used to ensure the validity of primary studies
Not reported.

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
Four primary studies were included in the analysis.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The probability of AMI was 0.1 (range: 0 - 0.05).
The probability of death was 0.039 (range: 0 - 0.3).
The RR of AMI from atenolol was 0.5 (range: 0.25 - 0.75).
The RR of death from atenolol was 0.5 (range: 0.25 - 0.75).
The RR of AMI from bisoprolol was 0.11 (range: 0.25 - 1).
The RR of death from bisoprolol was 0.22 (range: 0.25 - 1).
The RR of AMI from intraoperative esmolol was 0.33 (range: 0.25 - 0.75).
The RR of death from intraoperative esmolol was 0.5 (range: 0.25 - 0.75).
The RR of AMI from postoperative esmolol was 0.33 (range: 0.25 - 0.75).

The RR of death from postoperative esmolol was 0.5 (range: 0.35 - 0.75).

**Measure of benefits used in the economic analysis**
The authors calculated the efficacy of perioperative strategies in terms of utilities, with alive (either uncomplicated or complicated by AMI) as 1 and death as 0.

**Direct costs**
The perspective of the provider was adopted. The cost analysis was limited to the direct costs and included the costs of care of an AAA and the costs of pharmaceutical agents. The cost of care covered inpatient hospital, skilled nursing facility, home health care, outpatient hospital and physician fees. The cost data were obtained from 5% standard analytic files for the calendar years 1998 to 1999. The three groups of patients identified were in-hospital death, discharge alive with a diagnosis of AMI, and discharge alive without a diagnosis of AMI. The total hospital charges billed to Medicare were converted to costs using a cost-to-charge ratio of 0.75. The costs of pharmaceutical agents were determined by the average wholesale price from the Red Book. The price year was not stated. The costs and the quantities were not reported separately. Discounting was not carried out.

**Statistical analysis of costs**
No statistical analysis of the costs was performed.

**Indirect Costs**
The indirect costs were not included.

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way sensitivity analyses were conducted to assess the impact of variations in probabilities and utilities on the final decision.

**Estimated benefits used in the economic analysis**
The efficacy of no perioperative beta-blockers was 0.961.

All of the strategies involving acute perioperative beta-blockers were associated with an increase in efficacy, although less than the strategy involving preoperative oral titration.

The strategy involving preoperative oral titration (2) increased efficacy by a value of 0.0304 in comparison with no perioperative beta-blockers.

The strategies involving immediate preoperative atenolol (3), intraoperative esmolol plus postoperative atenolol (4), or intraoperative esmolol plus postoperative atenolol (5) increased efficacy by a value of 0.0195 in comparison with no perioperative beta-blockers.

**Cost results**
The total cost of no routine beta-blockers (strategy 1) was $28.9K.
The total costs of the other perioperative beta-blockade strategies were $28.4K (2), $28.6K (3), $28.5K (4) and $28.6K (5).

All perioperative beta-blockade strategies were associated with a net cost-saving in comparison with no routine beta-blockade strategy. The cost-savings were $0.5K with strategy 2, $0.2K with strategy 3, 0.1K with strategy 4 and $0.2K with strategy 5.

Synthesis of costs and benefits
The authors reported the average cost-effectiveness ratios.

Incremental cost-effectiveness ratios were not determined since all perioperative beta-blockade strategies were found to be more effective and less costly than no routine beta-blockers.

As the probability of death increased, the potential cost-savings and risk reduction increased. This suggested that the value of beta-blockers is a function of the underlying risk in the surgical population.

Authors' conclusions
Perioperative beta-blockade is cost-effective from a short-term provider perspective in patients with a suspected high rate of morbidity and mortality. The optimal strategy, based on limited data, is the administration of oral medication for a minimum of 7 days before surgery and continued administration of beta-blockers for at least 30 days postoperatively, with titration to a heart rate of 60 beats/minute. If a beta-blocker has not been started before the day of surgery, the authors' model suggests that either a short-acting intravenous or longer-acting oral medication will be cost-effective in high-risk surgery, although the optimal choice between these strategies is not now based on the available evidence.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator (no routine beta-blockers) was clear. You should determine if the alternatives analysed in this study are appropriate for your own setting.

Validity of estimate of measure of effectiveness
The principal input parameters for the model were derived from published studies. However, it was unclear whether the review was conducted systematically to identify relevant research and to minimise biases. The authors did not report the methods used to judge the relevance of the data or to combine the primary studies. However, the baseline probabilities were investigated in one-way sensitivity analyses.

Validity of estimate of measure of benefit
The efficacy of perioperative strategies in terms of utilities was modelled and used as the measure of benefits. The period of follow-up used in the model was unclear, but it appears to have been a short term period (less than 2 months). This limits the interpretation of the model's results. The tolerability of the beta-blocker therapies was not evaluated. The results would have been more comparable with other health care programmes if a quality of life outcome had been employed.

Validity of estimate of costs
Although the authors reported that they adopted the perspective of a provider, it was unclear whether all the relevant categories of costs were included. Few details of the cost items were given. In fact, only the overall categories of costs were presented. A breakdown of all the cost items was not provided. The resource quantities and the costs were not reported separately. Health resource utilisation was not derived from actual data but from published sources. These factors do not permit the analysis to be transferred to other settings. The cost estimates were treated deterministically and no sensitivity analysis on the costs was performed. Discounting was not performed since the costs were likely to have been incurred during less than one year.
Other issues
The authors compared their effectiveness findings with those from other studies. However, they did not address the issue of the generalisability of the results to other settings or countries. The authors reported limitations to their study, some of which have been highlighted already. For example, the limited number of studies to assess outcomes, the short-term provider’s perspective, and no assessment of quality of life. The authors do not appear to have presented their results selectively and their conclusions reflected the scope of the analysis.

Implications of the study
The authors recommended that the optimal strategy for treating patients who do not present to surgery already on beta-blockers requires further study. The risk-to-benefit ratio of beta-blocker therapy in patients without overt myocardial ischaemia undergoing surgery at lower risk also requires further study.

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