Forecasting the impact of clinical practice guideline for perioperative beta-blockers to reduce cardiovascular morbidity and mortality

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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 clinical guidelines when prescribing beta-blockers for high-risk patients undergoing major noncardiac surgery.

Type of intervention
Secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised high-risk adult patients undergoing major noncardiac surgery, such as orthopaedic procedures, vascular procedures, intra-abdominal procedures and intra-thoracic procedures. A detailed list of major noncardiac surgery was reported in the article. High-risk was defined as patients having either established coronary artery disease (CAD) or at least two major risk factors for CAD. Individuals undergoing one-day surgery or a second surgical procedure during a single hospitalisation were excluded.

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

Dates to which data relate
The effectiveness and resource use data were gathered from 2 January to 2 February 1999. Some effectiveness data were also derived from a study published in 1996. The price year was not reported but the costs were gathered mainly in 1999.

Source of effectiveness data
The effectiveness evidence was derived from a single study (Mangano et al., see Other Publications of Related Interest) and one authors' assumption.

Link between effectiveness and cost data
The costing was conducted retrospectively on the same sample of patients as that used in the effectiveness study.

Study sample
Power calculations were not conducted. Of a sample comprising 1,132 initially identified patients, 212 met the inclusion criteria and medical records were obtained for 158 of them. Of these, 81 had a high perioperative risk but 14
had initial contraindications to beta-blocker use. Therefore, the final sample of ideal beta-blocker candidates, according to the guidelines, comprised 67 patients. The patients were 45% male and most of them were in the 65- to 74-year age class. The second most numerous group (22%) was in the age class 75 years or over. As expected, eligible patients were older, more likely to be male and to undergo vascular or orthopaedic surgery. They also had a higher proportion of CAD, and more CAD risk factors (with the exception of smoker status) than patients who were considered not eligible according the guidelines.

Study design
The authors stated that this was a retrospective cohort study but, in reality, it appears to have been a simple historical case series. The evidence came from a single centre, the Baystate Medical Center in Springfield, Massachusetts. The effectiveness evidence was derived from the medical and administrative hospital database. The length of follow-up was unclear but it could have been one year. No patient appears to have been lost to the final assessment, as the medical records were likely to have been complete.

Analysis of effectiveness
All of the patients included in the initial study sample were accounted for in the analysis of effectiveness. The outcome measures used were the results of beta-blocker therapy, such as the proportion of patients who were unable to take medication by mouth after surgery, and those who developed a new contraindication.

Effectiveness results
Of the 67 ideal patients for beta-blocker therapy, only 25 (37%) had received a beta-blocker at some time perioperatively (31 patients if we included those receiving beta-blockers before admission).

The proportion of patients who were unable to take medication by mouth after surgery for an average of 3 days was 31%. In addition, 30% developed a new contraindication, hypotension being the most common (25%).

Of the 42 eligible patients who did not receive beta-blocker treatment perioperatively, 5 (12%) died before hospital discharge.

Clinical conclusions
Overall, the effectiveness analysis showed that 42% of all patients undergoing major noncardiac surgery were eligible for beta-blocker therapy.

Outcomes assessed in the review
The outcomes estimated from the completed study were overall and event-free survival in patients receiving beta-blockers (atenolol) versus placebo, one-year mortality and the one-year cardiovascular complication rate.

Study designs and other criteria for inclusion in the review
This was a randomised placebo-controlled trial.

Sources searched to identify primary studies
Not relevant.

Criteria used to ensure the validity of primary studies
The validity of the primary study appears to have been high due to the robust study design.
Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
The effectiveness evidence on beta-blockers was derived from one primary study.

Methods of combining primary studies
Not relevant.

Investigation of differences between primary studies
Not relevant.

Results of the review
The overall and event-free survival in patients receiving beta-blockers was significantly higher than in patients receiving placebo (the data were not reported).

The one-year mortality was 14% in the placebo group and 3% in the intervention group. The number-needed-to-treat (NNT) to prevent one death was 9.

The one-year cardiovascular complication rate was 22% in the placebo group and 8% in the intervention group. The NNT to prevent one cardiovascular complication was 7.

Methods used to derive estimates of effectiveness
The authors made a crucial assumption about the success of the guidelines.

Estimates of effectiveness and key assumptions
It was assumed that the guidelines were successful in 50% of the patients who appeared to be ideal candidates for beta-blocker therapy.

Measure of benefits used in the economic analysis
The summary benefit measure was the lives saved per year in comparison with no guidelines. This was obtained by combining data derived from the single study, treatment efficacy from the published study, and guideline success based on authors’ assumptions. This combination process also led to other intermediate measures, which will also be reported.

Direct costs
Discounting was not relevant since the costs were estimated during a one-year timeframe. The unit costs and the quantities were not presented separately. Administrative and medical services were included in the economic evaluation. Medical services comprised drugs (generic oral and intravenous atenolol) and telemetric monitoring. Administrative expenses comprised the following:

the costs to support 10% of the annual salary of the physician who served as the clinical champion during the programme’s first year, and 5% during subsequent years;

the costs to support 20% of the salary of the surgical case manager each year;

the computer programming costs; and
the printing and mailing costs to distribute the guideline to medical staff.

The cost/resource boundary of the study appears to have been that of the hospital. Resource consumption was based on the forecasted number of cardiovascular events averted each year, which was estimated on the basis of the estimated number of eligible patients receiving beta-blocker therapy. The costs were estimated from the hospital financial database. The prices were estimated in 1999, which was presumably the price year.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were not conducted.

Estimated benefits used in the economic analysis
The 95% confidence interval for the observed proportion of eligible patients suggested that between 35 and 50% of patients undergoing major noncardiac surgery were eligible for perioperative beta-blocker therapy. At the authors' institution, this would result in 890 to 1,272 patients per year.

Since about one third were already receiving beta-blocker therapy, there could be between 560 and 801 patients who could be considered as ideal candidates for beta-blocker therapy. Assuming a 50% success rate of the guidelines, some 280 to 400 patients would receive it.

Considering the possibility of developing a contraindication, there would be 196 to 280 patients actually receiving beta-blocker therapy during hospitalisation.

Based on the results of the reported published study, where the NNT to prevent one death was 9 patients, if all eligible patients at the authors' institution were to receive beta-blocker therapy, between 62 and 89 additional patients might be alive after one year.

Considering the limited effectiveness of the guideline implementation and the likelihood that some patients cannot tolerate beta-blockers, it was estimated that 22 to 31 lives would be saved every year. In addition, if all potential candidates received beta-blockers, the estimated number of cardiovascular events avoided per year would be between 80 and 114 (given an NNT of 7 to prevent one cardiovascular complication).

Again, considering the limited effectiveness of the guideline implementation and the likelihood that some patients cannot tolerate beta-blockers, it was estimated that 28 to 40 cardiovascular events would be prevented every year at the authors' institution.

Cost results
The total annual costs for the whole sample of patients who, at the authors' institution, would be considered eligible for beta-blocker therapy ranged from $33,661 to $40,210.

The reduction in treatment costs due to the fewer cardiovascular events was between $352,464 and $503,520.
Therefore, the implementation of the guidelines would result in overall savings of $318,803 to $463,310.

**Synthesis of costs and benefits**
An incremental cost-effectiveness ratio was calculated to combine the costs and benefits of the guideline implementation relative to no intervention. The incremental cost per life saved ranged from $1,297 to $1,530.

**Authors’ conclusions**
The implementation of guidelines to support clinicians in following recommendations made by the American College of Physicians, for the prescription of beta-blockers in high-risk patients undergoing noncardiac surgery, led to improvements in survival and a reduction in costs. The analysis also confirmed the authors’ hypothesis that beta-blockers were underused in the patient population considered in the study.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparator (no guidelines) was selected to reflect the standard approach for the perioperative treatment of patients undergoing noncardiac surgery. You should decide whether this is a valid comparator in your own setting.

**Validity of estimate of measure of effectiveness**
The analysis of effectiveness used data coming from several sources, which were then combined to assess the potential impact of the extension of beta-blocker use to all eligible patients. The single study was based on a historical case series. The design had several drawbacks, such as the retrospective nature and the lack of a comparison group. The evidence coming from the published study was robust, but it was unclear whether the study population was comparable with that considered in the current single study. Finally, the conservative assumption was not tested in the sensitivity analysis, which would have been helpful in assessing the robustness of the study conclusions. However, the authors presented all results in terms of confidence intervals and this enhanced the validity of the analysis. The authors noted that retrospective eligibility based on a review of patient charts might differ from eligibility evaluated during real clinical time. Also, the definition of major cardiac surgery appears crucial since this affects the choice of eligible patients.

**Validity of estimate of measure of benefit**
The summary benefit measure was derived from a calculation process, the steps of which were clearly reported. The use of number of lives saved rather than life-years gained makes comparison with the benefits of other health care benefits difficult.

**Validity of estimate of costs**
The perspective adopted in the study was not explicitly reported, but it could have been that of the hospital, which was used as the main source of the economic data. No information on the unit costs or the quantities of resources used was reported. The authors listed all items involved in the cost calculation, but it appears that it would be difficult to replicate the study in other settings due to the lack of detailed reporting in the paper. The resource use data were estimated using the averted cardiovascular events that were derived from the effectiveness analysis. Therefore, this was a hypothetical calculation based on assumptions and prior obtained evidence. Although the price year was not explicitly reported, most of the costs were estimated in 1999, which would facilitate reflation exercises in other settings. However, the costs were treated deterministically and were specific to the study setting since no sensitivity analyses were conducted.

**Other issues**
The authors made few comparisons of their benefits with those from other studies. They also did not address the issue of the generalisability of the study results to other settings. This affected the external validity of the analysis since no sensitivity analyses were conducted. The authors acknowledged that some uncertainty could have affected the calculation of potentially eligible patients. Some other limitations of the whole analysis were discussed.
Implications of the study
The authors noted that, until a more robust prospective study has been carried out, their study provides a reasonable estimate of the clinical and financial impact of perioperative beta-blocker therapy.

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None stated.

Bibliographic details

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Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
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