A cost-minimization analysis of laparoscopic cholecystectomy versus open cholecystectomy

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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
Laparoscopic cholecystectomy versus open cholecystectomy for the treatment of uncomplicated gallbladder disease.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients with symptomatic uncomplicated gallbladder disease.

Setting
Secondary care. The economic study was conducted in Stockholm, Sweden.

Dates to which data relate
The reference date was not reported for the effectiveness data or for the results on which the final analysis was based. The resource use data were based mainly on a previously published randomized study from 1994. The price date was 1993.

Source of effectiveness data
The estimate of effectiveness was based on opinion.

Modelling
A decision tree model was used to combine probabilities, consequences and costs for the laparoscopic and the open strategy. In the case of the laparoscopic strategy, if a common bile duct (CBD) stone was found, either laparoscopic choledocholithectomy, open choledocholithectomy or endoscopic sphincterotomy (ES) was performed. Alternatively, if no CBD stone was found, conversion to open cholecystectomy or laparoscopic cholecystectomy was undertaken. In the open strategy, if no CBD stone was found, open cholecystectomy was performed. If a CBD stone was found, either ES or open choledocholithectomy was conducted.

Outcomes assessed in the review
Eight outcomes were considered, 5 within the laparoscopic strategy and 3 for the open strategy.

For the laparoscopic strategy, laparoscopic choledocholithectomy, open choledocholithectomy, endoscopic sphincterotomy, conversion to open cholecystectomy and laparoscopic cholecystectomy outcomes were considered.
In the case of the open strategy, open choledocholithectomy, ES or open cholecystectomy were included.

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

**Sources searched to identify primary studies**
Uppsala University Hospital was used as a basis for modelling different outcomes. Whilst probabilities were assigned arbitrarily for most outcomes, one study and the Swedish Laparoscopy register were used for the others.

**Criteria used to ensure the validity of primary studies**
Not stated.

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

**Number of primary studies included**
Two primary data sources were used. The types of studies included were not reported.

**Methods of combining primary studies**
The two data sources were used to provide probabilities for 2 different outcomes, that is the probability of conversion to open cholecystectomy if no stone is found and the probability of finding a stone.

**Investigation of differences between primary studies**
Not included.

**Results of the review**
The probability of finding a CBD stone was set at 0.093. If no stone were found, the probability of conversion to open cholecystectomy was 0.099. If the open strategy were chosen, the probability of finding a stone was 0.093 and the probability of not finding a stone was 0.907. The authors considered each postoperative case (for the eight possible outcomes in the decision tree) as having the same health status.

**Methods used to derive estimates of effectiveness**
The authors assumed that the health outcome was equivalent across the two interventions compared.

**Estimates of effectiveness and key assumptions**
The authors considered each postoperative case (for the eight possible outcomes in the decision tree) as having the same health status.

**Measure of benefits used in the economic analysis**
Since the effectiveness analysis showed no difference in the clinical benefit between the intervention and the comparator, the economic analysis was based on the difference in costs only.

**Direct costs**
A discount rate of 5% was used. The resource quantities were reported separately from the prices. The costs measured were operating costs, capital costs, and costs associated with hospital stay. A societal perspective was adopted. The estimation of costs was based on actual data from previously published studies from 1993 and 1994. The sources were clinical studies, Swedish national registers, local patient statistics and hospital accounting systems. The price date was 1993. Capital costs associated with the open surgery were excluded since they were common to both strategies.

**Statistical analysis of costs**
Not stated.

**Indirect Costs**
These costs were not discounted. Resource quantities were reported separately from prices. The costs measured included those associated with productivity losses. The boundary was the "patient". The estimation of costs was based on data from studies published in 1993 and 1994. The sources were Swedish national registers and local patient statistics. The price date was 1993.

**Currency**
Swedish Kroner (SEK). The conversion rate reported as of 31 August 1994 was 1 = SEK11.90 and $1 = SEK7.76.

**Sensitivity analysis**
The parameters explored in the analysis were operation volume, estimated probabilities, operating time, anaesthesia time, hospital days, sick leave and discount rate. A one-way simple sensitivity analysis was used and a threshold analysis was undertaken.

**Estimated benefits used in the economic analysis**
Not applicable as benefits were assumed equivalent.

**Cost results**
It is not clear whether the 5% discount rate used for capital/investment costs was also used for all other costs. Assuming a total of 211 cholecystectomies were performed per year, the total expected cost of the laparoscopic strategy per patient was SEK25,878. The total expected cost per patient for the open strategy was SEK28,279. The intervention thus resulted in expected savings per patient of SEK2,401.

**Synthesis of costs and benefits**
A cost-minimisation study was conducted. The sensitivity analysis showed that, when varying all parameters (individually) by 50%, the results were sensitive to only two parameters: hospital stay following open cholecystectomy and sick leave following open surgery. The laparoscopic strategy becomes cost saving if at least 68 patients are operated on per year. The open strategy becomes cost-saving when the conversion rate is 19%. If the laparoscopic cholecystectomy operating time exceeds 134 minutes, the open strategy becomes the cost-saving procedure. Following the calculation of threshold values, the open procedure becomes cost-saving if sick leave related to laparoscopic surgery is greater than 18 days. The open strategy becomes cost-saving if sick leave relating to open surgery is under 18 days. If indirect costs are excluded, the open strategy is cost-saving.

**Authors’ conclusions**
From a societal perspective, the laparoscopic cholecystectomy approach was a more cost-effective strategy than open cholecystectomy if at least 68 patients were operated on per year. However, if indirect costs are not included, the open strategy was cost-saving and this was not sensitive to the operating volume.
CRD COMMENTARY - Selection of comparators

Open cholecystectomy was used as the comparator, given that it is the traditional standard of care.

Validity of estimate of measure of benefit

It is not clear that health benefits across the 2 interventions are equivalent.

Validity of estimate of costs

The quantities of resource use were reported separately from the prices. Adequate details of the methods of cost estimation were given, in particular with regard to capital costs. The capital costs associated with open surgery were excluded because they were considered common across the treatments. Capital costs were discounted but is seems unlikely that other costs were.

Other issues

The authors’ conclusions may not to be justified, given the uncertainties in the data and the limited sensitivity analysis performed (one-way only). The generalisability of the study results to other countries was not discussed. The comparison with previous studies resulted in the majority of these showing laparoscopy as a cost-saving strategy when only direct costs are included (as opposed to the present study which resulted in the open strategy being the cost-saving one when only direct costs were included). This was due in part to the difference in hospital days for the intervention relative to the comparator between this and other studies. The results were not presented selectively but more sensitivity analysis could have been usefully performed.

Implications of the study

The step towards a societal perspective in these 2 interventions is a positive one. This study shows that whilst one strategy may be appropriate from one perspective, another strategy may be appropriate from another.

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