Influence of surgeon volume on clinical and economic outcomes of laparoscopic 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
This study examined laparoscopic cholecystectomy (LC), undertaken by surgeons performing different volumes of procedures.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients undergoing LC for diagnoses of gallbladder stones, gallbladder polyps and acute cholecystitis. Patients diagnosed with gallbladder cancer were not considered.

Setting
The setting was a tertiary care centre. The economic study was carried out in Taiwan.

Dates to which data relate
The effectiveness and resource use data were gathered from January 1998 to April 2002. The price year was not reported.

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

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

Study sample
Power calculations were not reported. All eligible patients who underwent LC at the authors' institution over the timeframe of the study (4.4 years) were included in the analysis. A sample of 916 patients was considered. In the whole sample, the average age was 52.8 (+/- 12.9) years and 60.3% of the patients were male. Four surgeons performed all the interventions. The first surgeon performed 502 LCs (group A), the second performed 192 (group B), the third performed 147 (group C) and the fourth performed 75 (group D). The patients in group A had a mean age of 52.9 (+/- 12.6) years and 60.9% were men. Group B patients had a mean age of 53.4 (+/- 13) years and 62.5% were men. Group C patients had a mean age of 51.7 (+/- 13.2) years and 54.4% were men. Group D patients had a mean age of 52.2 (+/-...
14.4) years and 61.3% were men.

**Study design**
This was a retrospective cohort study that was carried out at a single institution, the Kaohsiung Medical University Hospital in Taiwan. Patient data were derived from the clinical database of the hospital. The length of follow-up was unclear. It was not reported whether any patients were lost to the follow-up assessment.

**Analysis of effectiveness**
All of patients included in the initial study sample appear to have been accounted for in the clinical analysis. The primary outcome measure used was the rate of complications. At baseline, the study groups were comparable in terms of age, gender, disease diagnosis, coexisting status, and route of admission. However, there was a statistically significant difference at study entry in pre-operation hospital stay and operation time for the LC patients of the four surgeon-groups: patients in group A had a lower operation time and shorter pre-operation stay. Mortality was not considered as an outcome measure because only 1 death occurred in the whole sample. A multiple logistic regression analysis was used to determine the relationship between volume-clinical outcomes while controlling for covariates.

**Effectiveness results**
The adjusted (unadjusted) complication rate was 0.24% (0.59%) in group A, 1.75% (2.6%) in group B, 0.26% (0.68%) in group C, and 1.31% (2.67%) in group D.

In comparison with surgeon A, surgeons B and D had significantly higher complication rates. The odds ratio (OR) for the comparison between surgeons A and B was 7.306 (95% confidence interval, CI: 1.475 - 36.174). The OR for the comparison between surgeons A and D was 5.432 (95% CI: 0.7668 - 38.48).

The statistical analysis showed that higher complication rates were significantly associated with patients who had a higher co-morbidity score, those who were admitted from the emergency department, and those who had an operation time longer than 90 minutes.

**Clinical conclusions**
The effectiveness analysis showed that the surgeon performing the highest number of procedures had the lowest complication rate.

**Measure of benefits used in the economic analysis**
No summary benefit measure was used in the economic analysis. In effect, a cost-consequences analysis was performed.

**Direct costs**
Discounting was not relevant since the costs were incurred during a short time period. The unit costs were not presented separately from the quantities of resources used. The economic evaluation comprised all hospital costs associated with LC. A detailed breakdown of the cost items was not given. The cost/resource boundary adopted in the study was not explicitly stated, but it could have been that of the hospital. The resource use data were derived from the same sample of patients who were included in the clinical study. The costs came from the hospital database. The price year was not reported.

**Statistical analysis of costs**
A multiple linear regression analysis was carried out to examine the relationship between volume and economic outcomes while adjusting for patient demographics and clinical information. Since the distribution of the economic outcomes (length of stay and costs) was skewed, a natural log transformation was used to achieve a more normal
distribution.

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

**Currency**
Taiwanese dollars (TWD).

**Sensitivity analysis**
Sensitivity analyses were not performed.

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

**Cost results**
The adjusted (unadjusted) length of stay was 4 (4.30) days in group A, 4.73 (5.50) days in group B, 4.28 (4.80) days in group C, and 4.48 (5) days in group D. The difference between surgeon A and surgeons B, C and D reached statistical significance, (p<0.05).

The adjusted (unadjusted) hospital charges were TWD 46,815 (46,365) in group A, TWD 51,508 (52,280) in group B, TWD 48,677 (49,037) in group C, and TWD 48,879 (49,447) in group D. The difference between surgeon A and surgeons B, C and D reached statistical significance, (p<0.02).

**Synthesis of costs and benefits**
A synthesis of the costs and benefits was not relevant since a cost-consequences analysis was performed.

**Authors’ conclusions**
The operative volume of individual surgeons had a positive impact on clinical outcomes and was also associated with shorter length of stay and lower hospital costs. In particular, the surgeon performing a high volume of procedures was associated with significantly lower complications rates and costs than those performing middle and low volumes of procedures.

**CRD COMMENTARY - Selection of comparators**
The selection of the comparators was appropriate for the objective of the study as surgeons with different volumes of procedures were considered. You should decide whether they are valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness analysis was based on the retrospective review of patient charts. The use of a prospective study would have been more appropriate. The lack of random allocation of the patients to the hospital groups could have introduced selection bias and confounding factors. In effect, the study groups were not well matched. Some statistical analyses were carried out to account for differences at baseline. No justification for the size of the sample was provided, but a large group of patients was used in the analysis. The evidence came from a single centre. These issues tend to limit the internal validity of the analysis.

**Validity of estimate of measure of benefit**
No summary benefit measure was used in the analysis because a cost-consequences analysis was conducted. Please refer to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

**Validity of estimate of costs**
The perspective adopted in the study was not explicitly stated, but it could have been that of the hospital. A detailed breakdown of the cost items was not provided, nor was information on the unit costs. The costs were obtained from patients' charges, which were not converted into actual costs. The price year was not reported. This makes it difficult to replicate the cost analysis in other contexts and reflate the costs in other time periods.

**Other issues**
The authors made some comparisons of their findings with those from other studies and found similar conclusions. The issue of the generalisability of the study results to other settings was not explicitly addressed and sensitivity analyses were not performed. This reduces the external validity of the analysis. The study referred to patients undergoing LC and this was reflected in the authors' conclusions. The authors noted some methodological limitations of their analysis. For example, the fact that the form of admission could have affected the results of the analysis and the potential impact of nursing care.

**Implications of the study**
The authors suggested that hospitals could develop practice guidelines based on high-volume surgeons to identify specific behaviours that could improve clinical outcomes and the use of resources.

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