Prevention of retained surgical sponges: a decision-analytic model predicting relative cost-effectiveness

Regenbogen SE, Greenberg CC, Resch SC, Kollengode A, Cima RR, Zinner MJ, Gawande AA

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.

CRD summary
The objective was to estimate the cost-effectiveness of screening strategies to prevent the occurrence of a retained surgical sponge in patients who underwent an average-risk in-patient operation. The authors concluded that bar-coded sponges were cost-effective across a range of plausible effectiveness estimates. The methodology was largely appropriate, but the authors' conclusions did not refer to an established cost-effectiveness threshold and should be considered with caution.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to estimate the cost-effectiveness of screening strategies to prevent a retained surgical sponge in patients who underwent an average-risk in-patient operation.

Interventions
The comparators were no screening, counting of sponges, X-ray for sponges in selected circumstances (obese patients, emergency operations, or unplanned changes in procedure), X-ray for sponges in all patients with or without counting, bar-coded sponges, and two types of radiofrequency-tagged sponges.

Location/setting
USA/in-patient.

Methods
Analytical approach:
The approach was a decision tree that expressed the probability of preventing a retained surgical sponge within each strategy. The time horizon was peri-operative and the authors stated that the perspective was that of the institution.

Effectiveness data:
The effectiveness data were from a combination of literature sources, related data, and personal communications. One randomised controlled trial was used and this compared bar-coded sponges with counting. All the remaining evidence was observational.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
The measure of benefit was the number of retained surgical sponge cases prevented.

Cost data:
The costs included X-ray, bar-coded sponges, and radiofrequency-tagged sponges. The unit cost per X-ray was from published reports. Those for the bar-coded and radiofrequency-tagged sponges were from personal communications and included the repayment of capital costs. The costs for no screening were assumed to be zero. Those costs associated with counting were excluded because it was assumed that counting did not affect the duration of the operation. All costs
were in US dollars ($).

Analysis of uncertainty:
Some one-way sensitivity analyses were conducted.

Results
The average cost per patient was $0.80 for counting, $30.31 for selective X-ray; $125 for universal X-ray with or without count; $10.60 for bar-coded sponges, and $75.31 for radiofrequency-tagged sponges of either type.

The rate of retained surgical sponges per 100,000 patients was 67 for no screening; 12 for counting; 9.4 for selective X-ray; 6.0 for universal X-ray without count; 3.0 for universal X-ray with count; 1.7 for bar-coded sponges; 1.7 for radiofrequency-tagged sponges type one, and zero for radiofrequency-tagged sponges type two.

The incremental cost-effectiveness ratios (ICERs) were $1,500 for count versus no screening, $95,000 for bar-coded sponges versus count, and $3,900,000 for radiofrequency-tagged sponges type two versus bar-coded sponges. All the other strategies were more costly and less effective than one of these three.

Counting and the bar-coded sponges were the only interventions with ICERs that remained below $200,000 in the sensitivity analyses.

Authors' conclusions
The authors concluded that bar-coded sponges were cost-effective across a range of plausible effectiveness estimates and the willingness to pay would vary by institution. They also proposed that their model could be useful for future analyses.

CRD commentary
Interventions:
The interventions were appropriate for the population and included standard practice, but the basis for selective X-ray was not clear as it included three very different criteria.

Effectiveness/benefits:
No literature review was reported and no clear justification was given for the selection of the parameter estimates. Little detail was reported on the way that some estimates were calculated in the decision tree and the data sources for the selective X-ray strategy were not reported. The measure of benefit appears to have been appropriate, but the longer term health consequences of retained surgical sponges could have been included. It was also not comparable with the benefits of other health care interventions.

Costs:
The cost categories were appropriate for the institutional perspective of the hospital or health care provider, but the long-term costs of retained surgical sponges could have been included. The calculation of the costs for the use of X-rays was unclear and the capital costs for bar-coded sponges and radiofrequency-tagged sponges were not reported separately. The price year was not stated, but from the sources of costs it was likely to have been 2008. Discounting was not relevant due to the short time horizon.

Analysis and results:
The costs and benefits were reported clearly and an incremental analysis was conducted. The model structure seems to have been appropriate for the evidence synthesis, but a lack of detail meant that it was not clear how it and the parameter estimates were used to calculate missing values. The sensitivity analyses were very limited and the basis for the ranges used was unclear. Several of the key estimates were based on personal communications and some information appeared to be missing, which means that generalisability will be limited.

Concluding remarks:
The methodology seemed to be largely appropriate, but the authors' conclusions did not refer to an established cost-effectiveness threshold and the reporting lacked transparency. The conclusions on cost-effectiveness should be
considered with caution.

**Funding**
Supported by the Agency for Healthcare Research and Quality, and SurgiCount Medical, Temecula, CA.

**Bibliographic details**

**PubMedID**
19375612

**DOI**
10.1016/j.surg.2009.01.011

**Original Paper URL**
http://www.surgjournal.com/article/S0039-6060(09)00073-7/abstract

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Contrast Media; Cost-Benefit Analysis; Decision Support Techniques; Foreign Bodies /economics /epidemiology /prevention & control; Humans; Incidence; Intraoperative Complications; Isotope Labeling; Models, Economic; Predictive Value of Tests; Sensitivity and Specificity; Surgical Sponges /adverse effects /economics

**AccessionNumber**
22009101467

**Date bibliographic record published**
17/06/2009

**Date abstract record published**
02/06/2010