Medical decision analysis of endoscopic surveillance of Barrett's oesophagus to prevent oesophageal adenocarcinoma
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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 endoscopic surveillance every 2 years in patients with Barrett's oesophagus (intestinal metaplasia in the distal oesophagus).

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The initial population consisted of 100,000 hypothetical patients aged 60 years who were suffering from Barrett's oesophagus.

Setting
The setting was tertiary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were gathered from studies published between 1984 and 2001. The resource use data were gathered from a study of 29 patients treated in a single hospital, which was published in 2001. The price year was stated to be 1999.

Source of effectiveness data
The effectiveness data were derived from a review of published studies and from the medical literature.

Modelling
A four-state Markov model, using an Excel spreadsheet, was used to estimate the costs and benefits.

Outcomes assessed in the review
The outcomes assessed in the review were:

the annual incidence rate of adenocarcinoma,

the 5-year survival after oesophagectomy for adenocarcinoma of the oesophagus (AdCA),
the health-related quality of life after oesophagectomy, and
the surveillance interval for endoscopy.

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 stated.

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

Number of primary studies included
Twelve primary studies were included in the review.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not stated.

Results of the review
The results of the review were as follows:

the incidence rate of adenocarcinoma was 0.5% per year for the baseline model (range for sensitivity analysis: 0.25 - 2.00);

the 5-year survival after oesophagectomy for AdCA was 20% for the baseline model (range for sensitivity analysis: 0 - 50);

the health-related quality of life after oesophagectomy was 100% for the baseline model (range for sensitivity analysis: 50 - 100); and

the surveillance interval for endoscopy was 2 years for the baseline model (range for sensitivity analysis: 1 - 10).

Methods used to derive estimates of effectiveness
The authors made assumptions on the basis of the medical literature. These were used to derive the efficacy of endoscopy in preventing AdCA and the starting age for surveillance using endoscopy.

Estimates of effectiveness and key assumptions
The efficacy of endoscopy in preventing AdCA was estimated to be 50% for the baseline model, with a range of 25 to
75% for the sensitivity analysis.

The starting age for surveillance was estimated to be 60 years for the baseline model with a range of 50 to 100 years for the sensitivity analysis.

**Measure of benefits used in the economic analysis**
For the measure of benefit in the economic analysis, the authors used the life-years saved adjusted to an index of health-related quality of life.

**Direct costs**
All the direct costs were estimated on the basis of the average payments by the US Health Care Finance Administration. Resource utilisation was calculated using a sample of 29 patients affected and treated for oesophageal carcinoma in a US hospital. The average payment by the US Health Care Finance Administration was used to convert resource use into financial costs. The quantities and the costs were reported separately. When calculating the total costs, the authors included the average number of medical, surgical and diagnostic services associated with oesophagectomy or medical care, and reimbursement to physicians and facility fees. The future costs were discounted at an annual rate of 3%. The price year was 1999.

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

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

**Currency**
US dollars ($).

**Sensitivity analysis**
A series of univariate and multivariate sensitivity analyses were conducted on a variety of variables. The variables included the cost of the endoscopic procedure, the costs of cancer care, operative mortality, starting age of surveillance, the length of the surveillance interval, health-related quality of life, the 5-year surveillance efficacy rate and incidence rate. Full details were given within the paper.

**Estimated benefits used in the economic analysis**
A strategy of biannual surveillance starting at an age of 60 years in a hypothetical population of 100,000 patients with Barrett's oesophagus, resulted in 51,091 years saved thorough curative surgery. This doubled the number of life-years saved without surveillance (26,326 life-years saved). The future life-years were discounted at an annual rate of 3%. The duration of benefits from the intervention was subjected to the annual age-specific death rate of the US population.

**Cost results**
The total cost of the surveillance programme for the study population was $626,227,558. The total costs of these patients without the surveillance programme were $206,107,863. The future costs were discounted using an annual rate of 3%. No statistical analyses of the costs were undertaken.

**Synthesis of costs and benefits**
The average cost-effectiveness ratio of surveillance was $12,257 versus $7,828 for a no surveillance strategy. The
incremental cost-effectiveness ratio of surveillance was calculated as the cost difference between the two strategies, divided by the difference in life-years saved between the two strategies, and was $16,695. A biannual endoscopic surveillance programme offers the chance of saving one life-year per $16,695 spent on endoscopy. In sensitivity analyses, the ratio fluctuated between $5,000 and $85,000 as different parameters were varied. The parameters that appeared to be most sensitive in the sensitivity analysis were health-related quality of life following surgical intervention, the incidence of oesophageal carcinoma and the 5-year survival rate. The authors stated that the incidence rate of adenocarcinoma is the most crucial parameter in the analysis. Decreasing this from 0.5 to 0.25% increased the incremental cost-effectiveness ratio to $35,400. Detailed results were presented in the paper.

Authors' conclusions
The authors concluded that "endoscopic surveillance of patients affected by Barrett's oesophagus and the prevention of oesophageal adenocarcinoma through surgery in this type of patient might be a cost-effective strategy under certain conditions".

CRD COMMENTARY - Selection of comparators
The rationale for the choice of comparator was clear. You should decide if "no surveillance" is an appropriate choice of a comparator in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness estimates were obtained from published literature. The methodology of the review was not reported and no inclusion or exclusion criteria were given. The authors provided no information on the methods used to combine the estimates, or if any such synthesis took place. In addition, it was not stated whether the impact of differences between the primary studies was considered.

Validity of estimate of measure of benefit
The measure of benefit was the health-related quality of life. However, the baseline results were presented as life-years saved. The life-years saved were then adjusted to a reduced health-related quality of life, which varied between 50 and 100%. At 50% the incremental ratio was $33,929, while at 100% the incremental ratio was $16,965. The percentage ratio used appears to have been arbitrary and no attempt has been made to define the quality of life at each level. Discounting was conducted at a rate of 3%. The authors used a single study to estimate the health-related quality of life after surgery and detail within the paper was limited.

Validity of estimate of costs
The analysis was reported as having been conducted from the perspective of a third-party payer. The indirect costs were therefore not appropriate and were not included by the authors. The resource use and the costs were reported separately and the price year was given as 1999 (fiscal). These issues aided the reflation of the study results to other settings. Discounting was carried out at a rate of 3%. The costs were treated deterministically, although detailed sensitivity analyses were conducted on the main cost items.

Other issues
The authors stated that their model was a relatively simple one with which to reflect some complexities, such as the natural history of Barrett's oesophagus (the progression to adenocarcinoma may depend on several factors) and the overall performance of surveillance as well as clinical practice (performance of doctors and procedural complication). As the authors noted, the model assumed a rational and efficient resource utilisation that is rarely achieved in practice. The model was also unable to reflect the intrinsic test characteristics such as sensitivity and specificity. The more factors considered in the model, the more the results shifted against surveillance. The issue of generalisability was not addressed. The authors presented comprehensive results, which were justified within the caveats outlined.
**Implications of the study**
It appears that, under certain conditions, surveillance using biannual endoscopy in patients with Barrett’s oesophagus seems to be cost-effectiveness when compared with non surveillance. In addition, this result falls within an adequate range of published league tables of different medical strategies. The authors stated that a surveillance programme focusing a priori on patients with an increased risk of oesophageal adenocarcinoma would be more effective than the first strategy.

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