A cost analysis of endoscopic ultrasound in the evaluation of esophageal cancer

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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
Three management care strategies in the staging of oesophageal carcinoma were considered. The first strategy was the use of computed tomography (CT) with guided fine-needle aspiration (FNA) of any suspicious-appearing celiac lymph nodes (CLNs) detected on CT. The second strategy was the use of endoscopic ultrasound (EUS) with guided FNA of any suspicious-appearing CLNs. The third strategy was to proceed directly to surgery. The detection of metastatic CLNs on FNA implied unresectability and prompted palliative management rather than surgery.

Type of intervention
Other: Management care and surgery.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of patients with apparently "resectable" oesophageal cancer on CT, that is, with no evidence of invasion of adjacent organs or distant metastases.

Setting
The setting was secondary care. The economic analysis was carried out in Rochester (MN), USA.

Dates to which data relate
The effectiveness data were gathered from studies published between 1984 and 2000. The resource data were gathered from studies published in 2001. Year 2001 prices were used.

Source of effectiveness data
The effectiveness data were derived from a review of published studies.

Modelling
A decision analytic model was created, using DATA 3.5 software, to simulate the clinical problem and the costs assigned to each screening strategy. The three management strategies modelled were CT FNA, EUS FNA and immediate surgery. Palliative management was considered to be combined chemotherapy and radiotherapy with endoscopic insertion of a metallic oesophageal stent. False-negative patients with FNA, and also patients with previously undetermined lymph node metastases, would undergo exploratory laparotomy and would then proceed to palliative oesophageal stenting with chemo-radiation.

The model was based on several assumptions. The assumptions made by the authors are reported in later sections of this abstract.
Outcomes assessed in the review
The outcomes assessed in the review and used as model inputs were:

the prevalence of CLNs;
the sensitivity of EUS FNA and CT FNA;
the laparotomy rate;
the rate of oesophageal stent and its complications;
the rate of requirement for a second oesophageal stent; and
the rate of oesophagectomy and its complications.

The morbidity and long-term side effects of radiation or chemotherapy were excluded from the model, being poorly quantified. Also excluded were the complication rates of EUS FNA, CT-guided FNA and exploratory laparotomy, as they had negligible effects on the results.

Study designs and other criteria for inclusion in the review
The authors reported that, to estimate the sensitivity of EUS FNA and CT FNA, only studies that had similar patient characteristics (i.e. patients with nonmetastatic oesophageal cancer) were included in the review. The study designs and criteria for inclusion for the other outcomes were not specified.

Sources searched to identify primary studies
Not specified.

Criteria used to ensure the validity of primary studies
Not specified.

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

Number of primary studies included
Approximately 26 studies were included in the review.

Methods of combining primary studies
The results of the individual primary studies were combined using a narrative method.

Investigation of differences between primary studies
The authors did not investigate any differences between the primary studies. The authors used baseline annual rates and examined the variability in sensitivity analyses.

Results of the review
The prevalence of CLNs was 20%. The sensitivity of EUS FNA was 80% and that of CT FNA was 40%.
The laparotomy rate was 15%, while the oesophageal rate was 25%.

The rate of oesophageal stent was 4%. The requirement for a second oesophageal stent was 15%.

**Measure of benefits used in the economic analysis**
The measure of benefit was the number of unnecessary surgeries avoided.

**Direct costs**
Hospital service costs were included in the analysis. The cost areas included were those relating to the staging procedures, oesophageal stent and associated hospitalisation, laparotomy, oesophagectomy and postsurgical care. The costs of pathology interpretation and palliative care were not included, as they were considered similar in each management arm. All the costs related to the procedures were obtained from Medicare reimbursement rates. The Medicare ambulatory patient classification plus professional fees for hospital-based outpatient procedures were used. It appears that the costs have been estimated using actual data, and the average costs were reported. The unit costs and the quantities of resources used were not presented separately. Year 2001 prices were used. Discounting was not undertaken, which was appropriate as the time horizon considered for the analysis was several days.

**Statistical analysis of costs**
A statistical analysis of the costs was not carried out.

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

**Currency**
US dollars ($).

**Sensitivity analysis**
One-, two- and three-way sensitivity analyses were performed on the probabilities of outcomes, using plausible ranges identified from the review of the literature. No sensitivity analyses on the costs were performed.

**Estimated benefits used in the economic analysis**
EUS FNA avoided 16 unnecessary surgeries per 100 patients evaluated, while CT FNA avoided 8 unnecessary surgeries per 100 patients evaluated.

**Cost results**
The total costs were $13,811 for EUS FNA, $14,350 for CT-guided FNA, and $13,992 for surgery only.

EUS FNA remained the least costly option, provided that the frequency of CLN involvement was greater than 16%. Below this value, surgery became the least costly strategy.

The results were also sensitive to variation in the sensitivity of EUS FNA. When this was less than 66%, surgery became the least costly option.

The two- and three-way sensitivity analyses showed that the results of the study were robust. EUS FNA remained the least costly strategy.
Synthesis of costs and benefits
The costs and benefits were not synthesised because the authors’ intention was to conduct a cost analysis.

Authors’ conclusions
The authors did not provide a conclusion in terms of both effectiveness and costs. They concluded that by minimising unnecessary surgery, primarily by detecting celiac lymph node (CLN) involvement, endoscopic ultrasound (EUS) with guided fine-needle aspiration (FNA) was the least costly staging strategy in the workup of patients with nonmetastatic oesophageal cancer. Under certain circumstances, surgery was the least costly strategy.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparators used. The authors included CT-guided FNA because it was the standard procedure for staging oesophageal cancer in their setting. You should decide if any of the strategies compared in the study are widely used health technologies in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature had been undertaken. The sources searched and the methods used to select the data were not reported. It appears that the effectiveness estimates have been combined using narrative methods. The impact of differences between the primary studies was not investigated. Sensitivity analyses, which varied the values of the effectiveness estimators, were performed using plausible ranges of variation. This increases the validity of the results. However, the authors showed that the model was sensitive to changes in both the sensitivity of EUS FNA and the prevalence of malignant celiac lymphadenopathy. In addition, the authors did not report the specificity of the CT-guided FNA and EUS FNA strategies. The rate of false-positive results (i.e. the number of inappropriate surgeries) was not considered.

Validity of estimate of measure of benefit
The authors intended to carry out a cost analysis. However, they reported the number of unnecessary surgeries avoided, which can be considered to be a measure of effectiveness.

Validity of estimate of costs
All the categories of costs relevant to the perspective adopted appear to have been included in the analysis. Some relevant costs items were omitted from the analysis. For example, the cost of palliative care was excluded from the analysis because it was common to each management strategy. Consequently, these omissions are unlikely to have affected the authors' conclusions. The costs and the quantities were not reported separately. The price year was reported, and some adjustments were considered. It should be noted that Medicare reimbursements were used as proxies of costs, and these do not reflect true opportunity costs. This limits the generalisability of the results. Discounting does not appear to have been relevant, as the follow-up considered in the analysis was no longer than a few days. The main drawback of the cost analysis was that a sensitivity analysis was not performed on the costs. Caution should therefore be taken when interpreting the results since the external validity of the study may be low.

Other issues
The authors did not compare their findings with those from other studies. The generalisability of the results was only briefly addressed. The authors considered that EUS FNA is best practised by an experienced endoscopist who maximises the EU FNA sensitivity. The authors reported a limitation of their study was the inclusion of the cost of oesophageal stent placement for all patients in the non-resection arm. This might have biased the final results in favour of the surgery strategy.

Implications of the study
The authors recommended that a relevant cost-effectiveness analysis, combining clinical outcomes with economic data
for comprehensive evaluations, should be conducted.

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