The clinical and economic impact of alternative staging strategies for adenocarcinoma of the pancreas

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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 authors evaluated seven alternative staging strategies for adenocarcinoma of the pancreas. These were laparoscopy (LAP), angiography followed by laparoscopy (ANG-LAP), endoscopic ultrasound followed by laparoscopy (EUS-LAP), laparoscopy followed by endoscopic ultrasound (LAP-EUS), laparoscopy followed by angiography (LAP-ANG), angiography followed by endoscopic ultrasound and laparoscopy (ANG-EUS-LAP), and endoscopic ultrasound followed by angiography and laparoscopy (EUS-ANG-LAP). Treatment consisted of surgical resection for patients with resectable tumours and non-surgical palliation for patients with unresectable disease.

Type of intervention
Diagnosis and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised 100 patients with pancreatic adenocarcinoma limited to the head of the pancreas on dynamic computed tomography (CT).

Setting
The setting was a hospital and the economic analysis was carried out in the USA.

Dates to which data relate
Effectiveness and resource use data were collected from studies previously published between 1979 and 1997. The dates of the cost data related and the price year were not reported.

Source of effectiveness data
Effectiveness estimates were taken from a review or synthesis of previously completed studies.

Modelling
A decision analytic model was used to simulate alternative staging strategies.

Outcomes assessed in the review
The review assessed the sensitivity and specificity of angiography, EUS, and LAP; and the probabilities of tumour resectability, obstructive jaundice, and duodenal obstruction.
Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

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
Twenty primary studies were included in the review.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
The sensitivity and specificity of angiography were 0.70 (0.70 - 1.00) and 0.91 (0.70 - 1.00), respectively.

The sensitivity and specificity of EUS were 0.91 (0.70 - 1.00) and 0.92 (0.70 - 1.00), respectively.

The sensitivity and specificity of LAP were 0.85 (0.85 - 1.00) and 1.00, respectively.

The probabilities considered were tumour resectability (0.33), obstructive jaundice (0.80), and duodenal obstruction (0.10).

Measure of benefits used in the economic analysis
The rate of curative resections was used as the measure of benefits in the economic analysis.

Direct costs
Direct costs were not discounted due to the short time horizon of the study (less than one year). Resource quantities were not reported separately. Direct costs were given by the costs of EUS, LAP, angiography, CT-guided biopsy, ERCP, duodenectomy, and jejunostomy. The quantity/cost boundary adopted was that of the hospital. Cost estimates were based on Medicare reimbursement rates. The price year was not reported.

Statistical analysis of costs
The authors reported the cost per patient, treated deterministically.

Indirect Costs
Indirect costs were not included.

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way sensitivity analyses were carried out on the model parameters within two ranges given for effectiveness and $600 - $2,000 for angiography and EUS.

**Estimated benefits used in the economic analysis**
Per 100 patients staged, LAP resulted in resection for all patients with resectable tumours and 40 surgical explorations in patients with unresectable disease. 91% of patients with resectable disease were correctly identified with ANG-LAP and LAP-ANG, although 13.2% of patients underwent an unnecessary exploration. 92% of patients with resectable disease were correctly identified with EUS-LAP and LAP-EUS, although 5.8% of patients underwent an unnecessary exploration. Strategies employing a confirmatory procedure after initial EUS or angiography had an appropriate resection rate of 99% and an inappropriate exploration rate of 15.5%.

**Cost results**
The cost per patient was:
- $18,100 with LAP,
- $13,400 with ANG-LAP,
- $11,400 with EUS-LAP,
- $15,400 with LAP-ANG,
- $13,800 with LAP-EUS,
- $14,500 with ANG-EUS-LAP,
and $14,000 with EUS-ANG-LAP.

**Synthesis of costs and benefits**
The cost per curative resection was:
- $54,800 with LAP,
- $44,600 with ANG-LAP,
- $37,600 with EUS-LAP,
- $51,200 with LAP-ANG,
- $45,300 with LAP-EUS,
- $44,300 with ANG-EUS-LAP,
and $42,800 with EUS-ANG-LAP.
The incremental cost-effectiveness of LAP over EUS-LAP was $257,000 per curative resection. The incremental cost-effectiveness of LAP over EUS-ANG-LAP was $2,033,000 per curative resection. The incremental cost-effectiveness of EUS-ANG-LAP over EUS-LAP was $108,000 per curative resection. EUS-LAP was stated to remain the most cost-effective strategy when the cost of EUS and angiography were varied. It was also stated that "the cost per curative resection was also sensitive to alterations of the sensitivity and specificity of EUS and angiography from 0.7 to 1.0."

Authors' conclusions
The authors argued that "staging strategies incorporating endoscopic ultrasound may improve treatment allocation and are cost-effective relative to angiography-based strategies. A staging protocol that does not incorporate an imaging modality to detect vascular invasion dramatically increases the cost per additional curative resection compared with more comprehensive staging protocols".

CRD COMMENTARY - Selection of comparators
A justification was given for the choice of comparators, namely that they represented commonly used clinical practices. You, as a user of the database, should decide if these health technologies are relevant to your setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature had been undertaken. More details about the sources searched, search strategies employed, and method of identifying, selecting and combining primary effectiveness estimates could have been provided.

Validity of estimate of measure of benefit
The estimation of benefits was obtained directly from the effectiveness analysis. The authors did not use a quality of life measure and this makes it difficult to compare the results with those from studies that report on similar health technologies.

Validity of estimate of costs
Good features of the cost analysis were that all relevant direct cost categories seem to have been included for the economic perspective adopted, and sensitivity analyses were performed. This would help in the replication of the results in other settings and in assessing the generalisability of the results. However, resource quantities and unit costs were not given, the price year was not reported, indirect costs related to absence from work and reduced productivity at work, and non-medical direct costs were not considered, and charges were used to proxy unit costs thus hindering a breakdown into unit costs and resource quantities. Also, the sensitivity analysis was quite limited with no justification being provided for the ranges used and incomplete reporting of the results. Given that the majority of patients succumb to recurrent disease, the authors argued that total costs were under-estimated. Given that indirect costs are higher for strategies with increased morbidity and mortality from unnecessary surgical explorations, the authors argued that the analysis was biased in favour of less aggressive staging strategies.

Other issues
The authors did not make comparisons of their findings with those from other studies, and only addressed the issue of generalisability to other settings through sensitivity analysis. The authors presented their results selectively for the sensitivity analysis. The study considered patients with pancreatic adenocarcinoma limited to the head of the pancreas on dynamic CT and this was reflected in the authors' conclusions. The authors acknowledged that they did not compare their results with those for other imaging strategies such as helical CT, magnetic resonance imaging, and laparoscopic ultrasound.

Implications of the study
The authors stated that this study supports the strategy employing an initial cross-sectional imaging technique to
determine the absence of metastatic disease, followed by a more sensitive technique such as EUS, to determine local resectability. This conclusion should be considered in the light of the caveats identified above.

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