The cost-effectiveness of fluorodeoxyglucose 18-F positron emission tomography in the NO neck

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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 positron emission tomography (PET) with 18-F fluoro-2-deoxyglucose (FDG) to obtain additional information before the decision to proceed with surgery, radiotherapy, or observation in patients with head and neck squamous cell carcinoma (HNSCC).

Type of intervention
Diagnosis and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised HNSCC patients with no evidence of lymph node involvement (classification N0 neck).

Setting
The setting was secondary care. The economic analysis was conducted in the USA.

Dates to which data relate
The effectiveness data were gathered from studies published between 1994 and 1998. The dates to which the cost data related were not reported. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a review of the literature.

Modelling
A decision tree was constructed, using Data software, to compare the costs and effectiveness of the PET scan versus no PET scan. Following the PET scan, there were two "chance" events, PET either positive or negative. Following a PET positive result, there was one "decision" node, the choice of surgery or radiotherapy. Following a PET negative result or no PET scan, there was one "decision" node, the choice of observation, surgery or radiotherapy. The duration of follow-up was 6 years.

Outcomes assessed in the review
The outcomes assessed in the review and used as model inputs were:
the prevalence of disease given a classification of N0 disease by computed tomography (CT);

the sensitivity and specificity of PET;

the probabilities of a positive or negative PET scan;

the probabilities of lymph node or no lymph node involvement conditional on a positive PET result; and

the probabilities of lymph node or no lymph node involvement conditional on a negative PET result.

**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 reported.

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

**Number of primary studies included**
Eight primary studies were included in the analysis.

**Methods of combining primary studies**
Not reported.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
The prevalence of disease given a negative CT scan was 28.60%.

The sensitivity of PET was 86.90% and the specificity was 94.80%.

The probabilities of a positive or negative PET scan were 28.60% (+) and 71.50% (-), respectively.

The probabilities of lymph node or no lymph node involvement conditional on a positive PET result were 87.00% (lymph node) and 13.00% (no lymph node), respectively.

The probabilities of lymph node or no lymph node involvement conditional on a negative PET result were 2.10% (lymph node) and 97.90% (no lymph node), respectively.

**Measure of benefits used in the economic analysis**
The benefit measures were the number of life-years saved and quality-adjusted life-years (QALYs) gained. Survival was estimated using data from the Surveillance, Epidemiology, and End Results (SEER) database (1999). The 6-year
survival rates were estimated using the Kaplan-Meier method. Life expectancy was estimated using the DEALE approach. Utility estimates were obtained from 8 surveys given to HNSCC patients, using a time trade-off method (how much healthy life would patients be willing to trade to avoid the morbidity of each of the treatments considered). The benefits were not discounted.

**Direct costs**

The perspective adopted was unclear, but it was likely to have been that of the hospital. Only the direct medical costs were included. These were the diagnostic costs (PET scan and physician fees) and treatment costs (modified neck dissection, radical neck dissection, radiotherapy, follow-up and physician fees) for inpatients and outpatients. Inpatient and outpatient costs were derived from the hospital's cost accounting database, which used a variant of the ratio of cost-to-charge methodology. The resource quantities and the costs were not reported separately. The price year was not reported. Discounting was not reported, although the duration of follow-up was 6 years.

**Statistical analysis of costs**

The costs were treated deterministically.

**Indirect Costs**

The indirect costs were not included in the analysis.

**Currency**

US dollars ($).

**Sensitivity analysis**

A one-way sensitivity analysis was performed for the cost of a PET scan and the prevalence of occult disease. The range of variation considered was large.

**Estimated benefits used in the economic analysis**

Modified radical neck dissection was associated with the lowest morbidity (0.925), while radical neck dissection plus follow-up radiotherapy was associated with the highest (0.675).

The PET scan strategy resulted in a life-expectancy at 6 years of 10.06 years. This was marginally higher than the 9.93 years expected from the strategy of no PET scan.

The number of QALYs gained with the PET scan (9.82 QALYs) was 0.442 in comparison with no PET scan (9.38 QALYs).

**Cost results**

The PET scan was more costly than the strategy of no PET scan. The expected costs were $4,679 (PET) and $3,572 (no PET), respectively.

**Synthesis of costs and benefits**

Compared with the strategy of no PET scan, the PET scan strategy resulted in an incremental cost-effectiveness ratio of $8,718 per year of life saved and $2,505 per QALY gained.

The sensitivity analysis showed that the PET scan strategy remained cost-effective as long as the cost of the scan was less than $50,052.
The sensitivity analysis showed that the PET scan strategy was also cost-effective as long as the prevalence of disease was between 16 and 36%.

**Authors' conclusions**

This study suggest that positron emission tomography (PET) is cost-effective as part of a strategy for treating class N0 necks in patients with head and neck squamous cell carcinoma (HNSCC).

**CRD COMMENTARY - Selection of comparators**

The reason for the choice of the comparator, no diagnostic imaging before the treatment decision, was clear. You should decide if this represents a valid comparator in your setting.

**Validity of estimate of measure of effectiveness**

The effectiveness data were derived from published studies. However, it was unclear whether a systematic review of the literature was performed to identify primary studies. In addition, the validity of the studies included in the review was not reported. These facts limit the internal validity of the effectiveness estimates obtained and used as model inputs. Although a sensitivity analysis was performed, it was only conducted for the prevalence of occult disease. The other estimates were not varied in the sensitivity analysis. These facts limit the relevance of the results obtained.

**Validity of estimate of measure of benefit**

The estimation of benefits was modelled. The decision analysis model used to derive a measure of health benefit was appropriate. An appropriate method was used to measure the utility estimates (using the time trade-off method). However, the sample size from which the utility estimates were derived was very small (8 patients). This fact may limit the validity of the estimates.

**Validity of estimate of costs**

The perspective adopted was unclear, but it was likely to have been that of the hospital. The resource quantities and the costs were not reported separately, and only limited details of the cost items included in the analysis were given. This means that it would be difficult to replicate the analysis in other settings. The dates to which the cost data related were not reported. The price year was also not reported. A sensitivity analysis was performed, but only for the cost of a PET scan. Discounting was not reported, although the duration of follow-up was 6 years. Consequently, there is uncertainty as to the validity of the cost analysis.

**Other issues**

The authors did not address the generalisability of the results, nor compare their findings with those from other studies. The authors highlighted some, but not all, of the limitations of their study (highlighted in other sections of the commentary). They do not appear to have reported the results selectively. This analysis must be considered preliminary due to the number of limitations of the study, both for the effectiveness and cost estimates.

**Implications of the study**

For the authors, these results argue for additional diagnostic imaging for patients with class N0 neck using FDG-PET. However, the authors acknowledged that additional research is warranted. This research should go beyond modelling treatment protocols and should prospectively study treatment strategies that use PET in the staging of neck lymph node.

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Bibliographic details

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Other publications of related interest


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Subject indexing assigned by NLM

MeSH
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