Primary staging of lymphomas: cost-effectiveness of FDG-PET versus computed tomography

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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 2-(fluorine-18) fluorodeoxyglucose positron emission tomography (FDG-PET) was compared with computed tomography (CT), as diagnostic procedures in the primary staging of malignant lymphomas.

Type of intervention
Diagnosis

Economic study type
Cost-effectiveness analysis.

Study population
The study used patients who underwent the diagnostic procedures in the primary staging of malignant lymphomas.

Setting
The setting was institutions. The economic study was undertaken in Ulm, Germany.

Dates to which data relate
The effectiveness data were collected between April 1997 and May 1998. The costs were originally calculated using the prices and costs of 1997. These were then inflated to 1999 figures using the growth rate of the price index of the gross domestic product (1.28%).

Source of effectiveness data
The effectiveness data were derived from a single study (see Other Publications of Related Interest).

Link between effectiveness and cost data
The costing was undertaken prospectively on the same patient sample as that used in the effectiveness study.

Study sample
The study sample comprised 22 patients examined in one of the two centres of the clinical trial (see Other Publications of Related Interest). The patients were prospectively and randomly selected. They were aged between 17 and 66 years (mean age: 39.1) and 12 (55%) were female. Thirteen patients (59%) had Hodgkin's disease (HD) and 9 (41%) had non-Hodgkin's lymphoma (NHL), 2 patients showing high-grade malignancy.

Study design
The study was a diagnostic test evaluation in which patients acted as their own controls. No information on blinding was provided. There was no follow-up beyond diagnosis (staging) and no loss to follow-up.

**Analysis of effectiveness**

It was not explicitly stated whether the basis of the analysis was intention to treat. The primary outcome measured was the percentage correct staging of patients with malignant lymphomas. The 'gold' standard was concordant (PET and CT giving the same result) and clarified discrepant findings. Discrepancies were clarified by "MRI (magnetic resonance imaging), biopsy or follow-up when possible".

**Effectiveness results**

Of the 511 anatomical regions evaluated in the 22 patients, 446 (87.3%) were evaluated concordantly. The remaining 65 (12.7%) were discordant. Twenty-five (38.5%) of the discordant findings were clarified by further examination through biopsy, MRI and follow-up. The results of these additional examinations indicated that PET was true positive 13 times, true negative 10 times and false positive twice. PET therefore caused an upstaging in 4 patients.

CT failed to identify the correct stage in 4 of the 22 patients. CT did not induce a change in stage. Therefore, the effectiveness of CT was 81.8% (18 out of 22) and that of FDG-PET, 100% (22 out of 22).

**Clinical conclusions**

In terms of diagnostic accuracy, FDG-PET was found to be more accurate in the primary staging of lymphomas than CT.

**Measure of benefits used in the economic analysis**

The main outcome measure in the cost-effectiveness study was the number of correctly staged lymphomas.

**Direct costs**

No discounting was undertaken as the study did not last for longer than a year. The costing of FDG-PET was divided into two steps, the production of FDG and the whole body FDG-PET scan. The cost components of the production process were investment and maintenance of cyclotron and equipment, staff working time and materials. The quantities used were measured using routine data and complementary expert opinion. The costs were originally calculated in German marks using the prices and unit costs for 1997. These were then inflated to 1999 figures using the growth rate of the price index of gross domestic product, then transformed into euros.

**Statistical analysis of costs**

A statistical analysis of the costs was not undertaken.

**Indirect Costs**

Indirect costs were not considered even though the study was stated to have been based on a societal perspective.

**Currency**

Euros. German marks converted into euros using a conversion rate of 1.95583 German marks = 1 euro.

**Sensitivity analysis**

A sensitivity analysis was carried out under various scenarios. Scenarios one and two envisaged variations in resource
consumption for the PET scan. This covered the PET utilisation time, working and number of films. Other scenarios covered developments already achieved or potential developments. The remaining scenarios covered hypothetical developments to assess the possible impact of an optimised utilisation of the PET facility.

**Estimated benefits used in the economic analysis**
The number of correctly staged malignant lymphomas by the diagnostic procedures being compared.

**Cost results**
The cost was 256.59 euros for FDG and 961 euros for FDG-PET.

The cost of CT was 364 euros for the lower limit and 418 euros for the upper limit.

An incremental analysis was carried out. The base-case results gave the incremental costs of CT versus no diagnostics as 478 euros, and that of FDG-PET versus CT as 3,133 euros.

The scenario 1 results were 445 euros for CT versus no diagnostics, and 2,629 euros for FDG-PET versus CT.

The scenario 2 results were 511 euros for CT versus no diagnostics, and 3,638 euros for FDG-PET versus CT.

The scenario 3 results were 478 euros for CT versus no diagnostics, and 3,030 euros for FDG-PET versus CT.

The scenario 4 results were 464 euros for CT versus no diagnostics, and 1,775 euros for FDG-PET versus CT.

The scenario 5 results were 478 euros for CT versus no diagnostics, and 2,662 euros for FDG-PET versus CT.

Finally, the scenario 6 results were 464 euros for CT versus no diagnostics, and 1,480 euros for FDG-PET versus CT.

**Synthesis of costs and benefits**
The costs and benefits were not combined.

**Authors' conclusions**
The diagnostic accuracy of 2-(fluorine-18) fluorodeoxyglucose positron emission tomography (FDG-PET) was found to be greater in the primary staging of lymphomas than computed tomography (CT). This higher accuracy might result in cost-savings because of the better planning of further diagnostic procedures and of treatment. The cost-effectiveness of using PET diagnostics may be improved, either by improvements in the procedure itself, or by regional planning of PET facilities or other measures aimed at increasing capacity utilisation.

**CRD COMMENTARY - Selection of comparators**
No explicit justification was given for the choice of the comparator used (no testing). However, it is generally good practice to use no testing as a comparator in case the least effective test was not cost-effective. You should consider whether these are widely used technologies in your own setting.

**Validity of estimate of measure of effectiveness**
The choice of the estimate of the measure of effectiveness was justified. The analysis used a diagnostic test evaluation design with self-controls, which was appropriate for the study question. However, it was not stated whether there was blinding. The study sample was representative of the study population, and the groups were shown to be comparable at analysis. One important issue was the strategy of not confirming concordant results. This implies an assumption that concordance prevents error. There are certainly cases where this would be an erroneous assumption, but this might not be the case here.
Validity of estimate of measure of benefit
The benefits were estimated directly from the effectiveness analysis. This choice of estimate was appropriate for a limited analysis, although final end points in terms of, for example, the life-years gained, would have been more useful.

Validity of estimate of costs
While the authors stated that the study was conducted from a societal perspective, not all the categories of cost relevant to the perspective were included in the analysis. The costs and the quantities were reported separately, thus improving transparency and permitting generalisability. A statistical analysis of the quantities was not performed.

Other issues
The authors made appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was addressed by performing a sensitivity analysis, as the authors acknowledged that their sample was relatively small. The authors reported a number of limitations to their study, such as the areas that were not covered by the procedure.

Implications of the study
The authors indicate that more research is needed to assess the long-term treatment and the cost and effects of more accurate staging.

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None stated.

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Other publications of related interest

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