Cost effectiveness analysis of FDG-PET in the differential diagnosis and staging of lung cancer in Japan

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
F-fluorodeoxyglucose Position Emission Tomography (FDG-PET) and chest Computerised Axial Tomography (CT) for the differential diagnosis of cancer. FDG-PET and brain Magnetic Resonance Imaging (MRI), abdominal CT and bone scan for staging of lung cancer.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
500,000 hypothetical patients who are suspected of having lung cancer following screening for lung cancer.

Setting
Hospital. The economic study was conducted in Tohoku university, National Sendai Hospital, and Sendai Kosei Hospital in Japan.

Dates to which data relate
The effectiveness data were derived from studies published between 1985 and 1996. The costs were based on those at the time of the study (1997).

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

Modelling
Simulation models were used to compare the cost-effectiveness of the conventional protocol for differential diagnosis of lung cancer using chest CT only with that including FDG-PET, and between the conventional protocol for staging lung cancer using brain MRI, abdominal CT and brain scan and that using FDG-PET.

Outcomes assessed in the review
The outcomes assessed were the sensitivity, specificity and accuracy of FDG-PET and CT for differential diagnosis of lung tumour and mediastinal lymph node metastasis of lung cancer.
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
21 studies were included in the review.

Methods of combining primary studies
Sensitivity, specificity and accuracy were calculated by the authors from the summation of the number of true positives, true negatives, false positives and false negatives reported in each study. As such the final figures used were a weighted average of all studies.

Investigation of differences between primary studies
Not stated.

Results of the review
For differential diagnosis of lung cancer FDG-PET has been shown to have 96.3% sensitivity, 78.6% specificity and 91.5% accuracy, while CT has been shown to have 99.7% sensitivity, 57.9% specificity and 78.8% accuracy. For the diagnosis of mediastinal lymph node metastasis of lung cancer, FDG-PET has 89.2% sensitivity, 90.6% specificity and 90.1% accuracy while CT has 67.1% sensitivity, 75.1% specificity and 72.5% accuracy.

Measure of benefits used in the economic analysis
The measure of benefits was the number of patients subjected to bronchofibrescope (BFS) biopsy in spite of having benign cancer and the number of missed cancer cases (for differential diagnosis of patients). For staging, the benefit measure was the number of patients correctly identified as either operable or non-operable.

Direct costs
Direct costs were calculated based on the current (1997) average costs. The costs included those necessary for examination and surgery, patient administration costs, films, data processing, hospitalization, and outpatient visits (first and subsequent). Discounting was not relevant due to the period of analysis.

Statistical analysis of costs
Not undertaken.

Indirect Costs
Not stated.
Currency
Japanese Yen.

Sensitivity analysis
Not undertaken.

Estimated benefits used in the economic analysis
In the differential diagnosis procedure without FDG-PET the number of biopsies performed would be 230,545 and with FDG-PET the number would be reduced to 57,692. This would result in 104 and 1,388 missed lung cancer cases for the two strategies, respectively. For the staging analysis with MRI, Abd, CT, and bone scan, the number of cases judged as being inoperable in spite of needing surgery would be 5,201 and the number judged as being operable in spite of being advanced would be 4,543. In the FDG-PET strategy for staging analysis, the number of cases judged as being inoperable in spite of needing surgery would be 1,963, and the number judged as being operable in spite of being advanced cases would be 1,491.

Cost results
For differential diagnosis of patients suspected of lung cancer, the conventional protocol using CT only would cost 39,800,000,000 yen while the protocol including FDG-PET would cost 49,900,000,000 yen. For differential diagnosis and staging of lung cancer, the conventional protocol using CT only would cost 45,500,000,000 yen while the protocol including FDG-PET would cost 43,300,000,000 yen. The protocol including FDG-PET therefore becomes less costly for the staging of lung cancer.

Synthesis of costs and benefits
Costs and benefits were not combined. In the differential diagnosis, the chest CT plus FDG-PET protocol reduced the number of bronchofiberscope (BFS) and biopsy by one fourth of that in the conventional protocol using CT alone. The PET protocol reduced unnecessary examinations for the patients of benign disease, but it increased the total cost of examinations by 25% because of the higher cost of PET than that of BFS and biopsy in Japan. In the staging of lung cancer, the FDG-PET protocol improved the accuracy of staging, reduced unnecessary surgery by 67%, and showed a saving of the cost of examination by 5%, and the total medical cost by 2.5% compared to that in the conventional protocol using CT, brain MRI and bone scan.

Authors’ conclusions
The use of FDG-PET for staging lung cancer may contribute to the improvement of diagnostic accuracy, to the reduction of examination cost and unnecessary operations and to the saving of the medical cost.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of comparator is clear as it was the conventional approach to differential diagnosis and staging of lung cancer.

Validity of estimate of measure of benefit
The benefits were derived from the estimates of sensitivity, specificity and accuracy of the diagnostic tests considered. In this respect the authors combined the findings of a high number of previously completed studies to produce a weighted result. However, no sensitivity analysis was undertaken to test for uncertainty in the data. The results were presented clearly and concisely.

Validity of estimate of costs
The authors derived average costs which were not subjected to statistical analyses or sensitivity analyses to test for variability.

**Other issues**
Bearing in mind the above limitations, which mainly derive from the use of a modelled solution, the authors presented a clear analysis of the potential use of the intervention and its clinical and economic benefits.

**Implications of the study**
Prospective, randomized controlled trials, where ethical, should be undertaken to validate the results of the present study.

**Source of funding**
None stated.

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