18FDG-PET-CT in the follow-up of non-small cell lung cancer patients after radical radiotherapy with or without chemotherapy: an economic evaluation

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.

CRD summary
This study investigated the best follow-up strategy, for non-small cell lung cancer patients after curative radiotherapy, using a combined approach based on positron emission tomography (PET) and computed tomography (CT). The authors concluded that the PET-CT follow-up was potentially cost-effective and was economically more attractive than CT alone, especially in asymptomatic patients. The study used robust methodology, especially for the analysis of uncertainty. Despite the limited reporting of some data sources, the authors’ conclusions appear to be valid.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to identify the best follow-up strategy for non-small cell lung cancer patients after curative intent with radiotherapy, using a combined approach based on positron emission tomography (PET) and computed tomography (CT).

Interventions
A fluorodeoxyglucose (FDG) PET-CT scan performed three months after treatment was compared against imaging on the basis of symptoms plus CT scan, and the usual follow-up of imaging on the basis of symptoms plus chest X-ray. All strategies also included the taking of a case history and a physical examination. An additional strategy of performing FDG-PET-CT scan only in asymptomatic patients was also considered.

Location/setting
Netherlands/out-patient setting.

Methods
Analytical approach:
The analysis was based on a Markov model, with a five-year time horizon, and a hypothetical cohort of non-small cell lung cancer patients treated with curative radiotherapy with or without chemotherapy. The authors stated that the analysis was carried out from the perspective of the health care system.

Effectiveness data:
The clinical evidence came from a selection of known, relevant studies. Data on the patient characteristics and on the ability of follow-up strategies to detect progression were based on a previous prospective study, which was performed at the authors’ institution and involved 100 patients. Other data were derived from the published literature, including a prospective study that assessed survival rates for non-small cell lung cancer patients. Expert opinions were used when no published sources were available. The key clinical endpoint was the ability to detect disease progression for each of the follow-up options.

Monetary benefit and utility valuations:
The utility values were derived from a published cross-sectional study and supplemented by expert opinion. No other details were given.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 1.5%. The expected survival was also reported.

Cost data:
The economic analysis included the costs of diagnostic tests (initial procedure and subsequent follow-up), resection, radiotherapy, palliative chemotherapy, and death (cancer-related terminal care or death from other causes). The costs of diagnostic procedures and treatment were obtained from the Dutch Insurance Board. Recommended dosages were used for chemotherapy cycles. Other costs were based on estimates provided by the UK National Institute for Health and Clinical Excellence (NICE) and a published report. All costs were in Euros (EUR) and the price year was 2008. Future costs were discounted at an annual rate of 4%.

Analysis of uncertainty:
A probabilistic sensitivity analysis was undertaken using pre-specified probability distributions for the key model inputs. A Monte Carlo simulation was used to generate cost-effectiveness acceptability curves. The patient and population expected value of perfect information (EVPI) were also calculated.

Results
The expected costs per patient were EUR 13,983 with usual chest X-ray follow-up, EUR 14,269 with CT follow-up, and EUR 15,266 with PET-CT follow-up. The QALYs were 1.28 with usual follow-up, 1.28 with CT, and 1.30 with PET-CT. The incremental cost per QALY gained compared with usual follow-up was EUR 264,033 for CT and EUR 69,086 for PET-CT. For PET-CT in the subsample of asymptomatic patients, it was EUR 42,265.

In the whole sample, the probabilistic analysis showed that there was considerable uncertainty regarding the optimal diagnostic strategy. At a ceiling ratio of EUR 80,000 per QALY, as suggested by Dutch guidelines, the probabilities of being cost-effective for PET-CT (48%) and for usual follow-up (47%) were similar. In the subgroup of asymptomatic patients, the probability of PET-CT being cost-effective rose to 73% and it fell to 27% for usual follow-up.

The population EVPI was EUR 423 million, with PET-CT follow-up for all patients, and EUR 125 million, with PET-CT only for asymptomatic patients, showing less uncertainty in the latter case.

Authors' conclusions
The authors concluded that PET-CT follow-up was a potentially cost-effective diagnostic strategy and was economically more attractive than CT alone, especially in asymptomatic patients.

CRD commentary
Interventions:
The selection of the comparators was appropriate in that the current patterns of care for this patient population were compared against the proposed new approach. The comparators were commonly used in the follow-up of non-small cell lung cancer patients.

Effectiveness/benefits:
A selective approach appears to have been used to identify the relevant sources of data. The bulk of the evidence was derived from a prospective study and the key details on its methods and results were reported. The main issue of this study, which was acknowledged by the authors, was its small sample size. Other sources of data were not fully reported and it is therefore difficult to make an objective assessment of the validity of the clinical estimates. The authors did not investigate specific issues related to the use of mixed sources. The methodological approach used to derive the utility values from the published study was not described. QALYs are a validated benefit measure, which not only capture the impact of the diagnostic procedures on the patients' health, but also allow cross-disease comparisons to be made.

Costs:
The analysis of costs was consistent with the economic perspective in terms of the cost categories, but the unit costs and resource quantities were not reported separately for most items, which limits the ability to replicate the study. Some data were derived from a previous study, the methodological characteristics of which were not described. Some of the cost categories were treated as probabilistic given the uncertainty around their mean value. Other details such as the
price year and the discount rate were reported.

Analysis and results:
The costs and benefits were clearly reported. The use of an incremental analysis was appropriate for combining the model outcomes. The issue of uncertainty was satisfactorily addressed using a probabilistic approach, the findings of which were extensively presented and discussed. The external validity of the study was not explicitly investigated. The model structure and assumptions were appropriately described. The authors acknowledged some limitations of their study mainly related to the uncertainty around the clinical estimates. The use of EVPI was a positive feature of the analysis.

Concluding remarks:
The study used robust methodology, especially for the analysis of uncertainty. Despite the limited reporting of some data sources, the authors' conclusions appear to be valid.

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