

Cost-effectiveness analysis of strategies introducing FDG-PET into the mediastinal staging of non-small-cell lung cancer from the French healthcare system perspective

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Received 4 June 2004; received in revised form 3 October 2004; accepted 8 October 2004

KEYWORDS

Decision trees; Cost-effectiveness; Economics; Non-small-cell lung carcinoma; Fludeoxyglucose F18; Positron emission tomography

AIM: To determine the most cost-effective strategy using PET for mediastinal staging of potentially operable non-small-cell lung cancer (NSCLC).

METHODS: Four decision strategies based on French NSCLC work-up practices for the selection of potential surgical candidates were compared, comprising CT only, PET for negative CT, PET for all with anatomical CT, and CT and PET for all cases. The medical literature was surveyed to obtain values for all variables of interest. Costs were assessed with reimbursements from the French healthcare insurance for the year 1999. Expected cost and life expectancy were calculated for all possible outcomes of each strategy. Sensitivity analysis was performed to determine the effects of changing variables on the expected cost and life expectancy.

RESULTS: Compared with the CT only strategy, CT and PET for all resulted in a relative reduction of 70% of surgery for persons with mediastinal lymph node metastasis. PET for all with anatomical CT was shown to be a cost-effective alternative to the CT only, with life expectancy increased by 0.10 years and expected cost savings of 61 euros. This strategy was more favourable than PET for negative CT. Overall, sensitivity analyses showed the robustness of the results.

CONCLUSION: The introduction of thoracic PET for NSCLC staging is potentially cost-effective in France. Further clinical investigation might help to validate this result.

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Introduction

Prognosis of lung cancer remains poor and has not improved appreciably over the last two decades. In

2000, lung cancers led to 27,164 deaths in France with a mortality rate standardized to Europe of 36.6 per 100,000.¹ There were 27,743 cases of newly diagnosed lung cancers in France in 2000.² Non-Small-Cell Lung Cancer (NSCLC) represents 80% of all lung cancers. Its survival rate appears to be better if patient is medically operable and the tumor is resectable. Staging work-up of NSCLC aims to identify patients who will potentially benefit from surgical treatment from those with

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mediastinal lymph nodes metastasis (stages N2 or N3). N2 status refers to metastasis to ipsilateral mediastinal and subcarinal lymph nodes. N3 status refers to metastasis to contralateral mediastinal, contralateral hilar, ipsilateral or contralateral scalene, or to supraclavicular lymph nodes. N1 refers to metastasis to lymph nodes in the peribronchial or the ipsilateral hilar region.^{3,4}

Currently, Computed Tomography (CT) of the chest is an accepted tool for staging mediastinal lymph nodes. Because of its low specificity, surgical biopsy by cervical mediastinoscopy or thoracoscopy, or both, is necessary to achieve an accurate mediastinal stage. However these surgical procedures present inherent risks and significant costs.⁵

2-[Fluorine-18] Fluoro-2-Deoxy-D-Glucose (FDG) Positron Emission Tomography (PET) appears to be particularly promising. PET can identify biopsy-proven metastasis that are not identified by other tests in 10% to 20% of potentially operable patients with NSCLC.⁶ Recently, the PLUS study group (PET in Lung cancer Staging) conducted a randomised clinical trial and concluded that addition of FDG-PET to conventional work-up staging of NSCLC prevented unnecessary surgery in one out of five patients with suspected NSCLC, therefore FDG-PET may be included in the routine NSCLC staging protocol.⁷

Recent studies using decision-tree analysis have suggested the potential cost-effectiveness of using FDG-PET for the management of NSCLC.⁸⁻¹³ This findings could not be valid in every health care system without taking into account specificity of costing of medical care and alternative clinical practices in health care system.^{14,15} Published decision tree models should consider the specificity of medical costs data or insurance reimbursement systems and should reflect the practice of physician in different health care system.¹⁶ Consultation of leader's opinion in our academic university hospital showed that the discrepancy between published decision tree analysis and reported experience in France health care system is particularly high for staging NSCLC. Since costs structures may differ in France from those in other countries and discrepancy exists between published models and actual practices, it was felt important that an incorporation of local costs and practices should be made to adjust the published models.

The objective of this work was to develop a decision analysis model to compare the cost-effectiveness of various strategies of mediastinal staging of potentially operable NSCLC combining

CT, PET and biopsy from the French health care system perspective.

Material and method

Base-case

The base-case was a 65-year-old patient, in whom NSCLC has been histologically established and assessed as operable. Distant metastases had not been detected and the tumour was assessed as locally resectable by conventional staging. Estimates of the proportion of patients with a mediastinal metastasis disease at presentation varied with criteria for resectability ranging from 28% to 38%.¹⁷ So up to three-quarter of the patients with NSCLC were excluded from the base-case of our analysis.

General description of the model

We performed cost-effectiveness analysis from the French national public health system insurance perspective using a decision tree model.¹⁸ Strategies comprised of sequences of particular clinical events with associated estimated transitional probabilities. At the end of each alternative arm of the tree (represented by a terminal node), payoffs were assigned corresponding to the total cost of care and life expectancy in years. Data 4.0 software (Tree-Age, Inc Williamston, MA) was used to construct the decision tree and rolled back for analysis.

Structure of decision trees

Four strategies labelled CT only, PET for negative CT, PET for all with anatomical CT, and CT and PET for all were established (Fig. 1(a)-(d)).

The baseline strategy uses only thoracic CT for non-invasive preoperative staging, whereas other strategies include the use of thoracic PET in different approaches. For all these strategies, we assumed that biopsy of mediastinal lymph nodes is performed by cervical mediastinoscopy (CM), which was assumed to be equally sensitive to identify ipsilateral and contralateral mediastinal enlarged lymph node.

Reports that focused on the indications for CM in patients with NSCLC are controversial. Some authors recommend CM for all patients who are being considered for thoracotomies,^{5,19} whereas others insist that CM is indicated only when mediastinal involvement is suspected.^{20,21} Unfortunately, some lymph node levels are not accessible

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