Cost-effectiveness of 99mTc-sestamibi in predicting response to chemotherapy in patients with lung cancer: systematic review and meta-analysis

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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.

CRD summary
The objective was to undertake a systematic review of the performance of $^{99m}$Tc-methoxyisobutylisonitrile ($^{99m}$Tc-MIBI) imaging in the assessment of drug resistance in lung cancer and to analyse the cost-effectiveness of $^{99m}$Tc-MIBI imaging in the selection of patients for chemotherapy. It was found that $^{99m}$Tc-MIBI imaging was cost-effective from the perspective of the UK National Health Service. This study was based on valid methodology, but with limited reporting of the economic data. In general, the authors’ conclusions appear to be valid.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to systematically review the performance of $^{99m}$Tc-methoxyisobutylisonitrile ($^{99m}$Tc-MIBI) imaging in the assessment of drug resistance in lung cancer and to analyse the cost-effectiveness of $^{99m}$Tc-MIBI imaging in the selection of lung cancer patients for chemotherapy.

Interventions
Three strategies were considered: basic supportive care (BSC); treatment for all patients; and the use of $^{99m}$Tc-MIBI to select patients for chemotherapy. The chemotherapy was assumed to be paclitaxel based.

Location/setting
UK/hospital.

Methods
Analytical approach:
This economic evaluation was based on a decision modelling framework. A short time horizon was necessary, given the poor survival of lung cancer patients. The authors stated that the perspective was that of the UK National Health Service (NHS).

Effectiveness data:
The clinical data for the accuracy of $^{99m}$Tc-MIBI imaging were derived from a systematic review, the key details of which were reported. MEDLINE was the main database searched and this was supplemented with data from other online databases. Case reports were excluded and only studies in which the initial imaging had been performed within 30 minutes of the tracer injection were included. A total of eight studies, with 235 patients, were selected and estimates from these studies were combined in a meta-analysis. The treatment effect for chemotherapy was mainly derived from randomised controlled trials (RCTs). The primary clinical estimate was the $^{99m}$Tc-MIBI imaging accuracy (its sensitivity and specificity).

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
Life-years (LYs) were the summary benefit measure. The expected survival was derived from clinical trials, which were part of a health technology assessment (HTA) for the NHS. This was adjusted for the prevalence of responders, which
was determined by the meta-analysis.

Cost data:
The economic analysis included the costs of $^{99m}$Tc-MIBI imaging, chemotherapy (paclitaxel-based), and BSC. The economic data were derived from two main sources: the NHS HTA mentioned above, and the UK National Institute for Health and Clinical Excellence (NICE) guidelines. A breakdown of cost items was not given and costs were presented as macro-categories. They were in UK pounds sterling (£) and the price year was not reported.

Analysis of uncertainty:
A deterministic sensitivity analysis was undertaken to investigate the impact of variations in the prevalence of responders, $^{99m}$Tc-MIBI imaging sensitivity and specificity, and chemotherapy costs. In a worst-case scenario, the cost of $^{99m}$Tc-MIBI was doubled. Confidence intervals (CIs) from the meta-analysis were used for the clinical inputs and chemotherapy costs were varied according to NICE guidelines.

Results
The expected costs were £6,283 with treat-all, £5,047 with imaging, and £3,210 with BSC. The LYs were 0.78 with treat-all, 0.76 with imaging, and 0.43 with BSC. The average cost-effectiveness ratios were £8,093 with treat-all, £6,678 with imaging, and £7,408 with BSC.

The incremental cost per LY gained with treat-all over imaging was £60,051 (95% CI: 46,795 to 73,860), which was above the threshold of £30,000 per LY gained recommended by NICE. Thus, the imaging strategy was the most cost-effective option.

This finding was confirmed in the one-way sensitivity analysis, which showed that the incremental cost-effectiveness ratio of treat-all remained above the NICE threshold in all scenarios, except when the cost of chemotherapy was as low as £3,700 (it was above £6,000 in the base case) or the cost of $^{99m}$Tc-MIBI imaging was doubled.

Authors' conclusions
The authors concluded that $^{99m}$Tc-MIBI imaging was an accurate approach to selecting lung cancer patients for chemotherapy and was a cost-effective strategy from the perspective of the UK NHS. They recommended that a RCT should be carried out to confirm the role of $^{99m}$Tc-MIBI imaging in the management of patients with lung cancer.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear. The strategies were three of the available options for lung cancer patients. Other imaging techniques were not considered.

Effectiveness/benefits:
The approach used to derive the clinical estimates was appropriate in that the available literature was searched in order to identify the relevant sources of data. The key methods and conduct of this review were reported. Furthermore, the use of a meta-analysis to synthesise the clinical data was appropriate, and provided confidence intervals for the sensitivity analysis. In general, the clinical analysis was well carried out. The derivation of the benefit measure was based on NICE data, and these are usually estimated using a rigorous and valid approach. LYs are an appropriate benefit measure and allow cross-disease comparisons to be made.

Costs:
The analysis of costs was restricted to the items relevant to the NHS perspective. The sources of data were reported and appear to have been relevant to the perspective. These costs were, however, presented as macro-categories and were not broken down into individual items, which reduces the transparency of the economic analysis. The resource quantities, unit costs, and the price year were not given, and cost estimates were treated deterministically.

Analysis and results:
The costs and benefits were appropriately analysed using both average and incremental cost-effectiveness ratios. The results were clearly presented. The sensitivity analyses considered only a few aspects of the issue of uncertainty and a
more comprehensive approach would have been useful. The findings were quite robust, even in some unfavourable scenarios. The authors stated that the use of $^{99m}$Tc-MIBI imaging might save resources for the NHS in the UK with limited loss in life expectancy (7.5 days in this study). This finding could also be transferable to other countries.

Concluding remarks:
This study was based on valid methodology, although more detailed reporting of the economic data would have been interesting. In general, the authors’ conclusions appear to be valid.

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