The importance of sputum cytology in the diagnosis of lung cancer: a cost-effectiveness 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.

Health technology
Initial testing with sputum cytology.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
Patients with pulmonary (chest or peripheral) lesions seen on chest radiographs.

Setting
Hospital. The economic study was carried out in the United States.

Dates to which data relate
Test characteristics (sensitivity, specificity, complication rates and morbidity rates) were based on the literature published between 1980 and 1995. Life expectancies were based on reports dated 1986 and 1994. Costs were reported in 1995 US dollars.

Source of effectiveness data
Effectiveness data were based on a review of previously completed studies.

Link between effectiveness and cost data
The costing was undertaken retrospectively.

Modelling
A decision tree of the sequence of tests and treatments for patients with central or peripheral lesions seen on a chest radiograph was used to estimate outcomes and costs of the alternative strategies.

Outcomes assessed in the review
Life expectancies and test characteristics (such as sensitivity, specificity, complication rates and morbidity rates) were assessed in the review.
Study designs and other criteria for inclusion in the review
Life expectancies were derived from published reports of the Surveillance Epidemiology and End Results Program and the National Center for Health Statistics in the United States. No details were provided of inclusion criteria for studies used to determine test characteristics.

Sources searched to identify primary studies
The MEDLINE database was searched for the period 1980-1995.

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
Not stated.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
Assumed life expectancies were:

no cancer = 25 years;
local cancer-surgery = 6 years;
regional cancer-surgery = 2 years;
distant cancer-surgery = 1 year;
local cancer-no surgery = 2.5 years;
regional cancer-no surgery = 2 years;
distant cancer-no surgery = 1 year;
metastatic cancer-no surgery = 1 year.

The true-positive rate, true-negative rate, probability of procedural death and probability of nonfatal complications for each of the following tests in patients with central lesions were:
sputa, 40%, 95%, 0% and 0%;
FNA, 80%, 95%, 0.05%, 15%;
bronchoscopy, 75%, 95%, 0.1%, 15%;
thoracoscopy, 100%, 100%, 0.5%, 15%.

In patients with peripheral lesions the respective rates were:
Sputa, 20%, 95%, 0%, 0%;
FNA, 85%, 95%, 0.05%, 15%;
bronchoscopy, 30%, 95%, 0.1%, 15%;
thoracoscopy, 100%, 100%, 0.5%, 15%.

Measure of benefits used in the economic analysis
The outcome measure used in the economic analysis was life years saved. A decision-tree was used to estimate expected life years of the alternative test strategies. Life expectancies were discounted at a fixed annual discount rate of 3%.

Direct costs
The cost of testing and initial treatment included all expenses associated with the testing procedures, test complications, staging, staging complications, initial treatment and treatment complications. Test-associated costs were calculated from costs obtained from the billing offices of Stanford University and the University of Iowa (these included both a procedural and a pathology cost). The total cost of medical care includes the cost of testing plus the expenses associated with all testing, initial treatment and follow-up care. The medical costs represent those derived from patient billing records (Northern California Kaiser Permanente Hospitals), and include both total hospital discharge and home healthcare costs. Costs were discounted at a fixed annual discount rate of 3%.

Statistical analysis of costs
Not performed.

Indirect Costs
Not included.

Currency
US dollars ($).

Sensitivity analysis
A one-way simple sensitivity analysis was performed on the benefits by varying the pretest probability of cancer. The effect of this on the difference in life expectancy, difference in lifetime cost of medical care and cost-effectiveness in central and peripheral lesion cases was determined.

Estimated benefits used in the economic analysis
For central lesions: SBFE resulted in 19 fewer deaths per 100,000 patients compared to the non-sputa strategy of BFE. Life expectancy was 9.88 years for both SBFE and BFE, and 9.57 years for T, (a difference of 114 days). Life expectancy was 9.87 years for SFT, SBFT and FT; 9.86 years for SBT, ST, BFT and BT. For peripheral lesions SFBE resulted in 4 fewer deaths per 100,000 patients compared to the non-sputa strategy of FBE. Life expectancy was 9.783 years for SFBE and 9.778 years for FBE, (a difference of 0.8 days). Life expectancy was 9.78 years for SFT and SFBT and 9.779 years for FT, FBT, ST and T.
Cost results
For central lesions, the cost of testing and initial treatment was $5,120 for SBFE, $5,450 for BFE and $11,217 for T. The lifetime cost of medical care was $24,561 for SBFE, $24,712 for BFE and $33,984 for T. For peripheral lesions, the cost of testing and initial treatment was $5,047 for SFBE, $5,064 for BFE and $11,236 for T. The lifetime cost of medical care was $24,460 for SFBE, $24,322 for FBE and $35,099 for T.

Synthesis of costs and benefits
Initial sputa examination costs $27,600 per year of life saved. In the other three comparisons, initial sputa examination results in lower medical cost and equivalent or longer life expectancy. Sensitivity analysis of the effect of varying the pretest probability of cancer on the difference in life expectancy, difference in lifetime cost of medical care, and cost-effectiveness in the central-and peripheral-lesion cases, revealed that sputa testing costs less per life-year saved in patients presenting with central lesions and is less costly for selected patients with peripheral lesions; in particular, in patients whose probability of cancer is more than 50%. The authors found that the lower cost and better survival, especially in patients with central lesions, remained stable to variation in other reference-case assumptions.

Authors' conclusions
The authors concluded that for patients who undergo diagnostic evaluation of suspected lung cancer (particularly those patients presenting with centrally located lung lesions) the addition of sputa examination as an initial test shows significant promise in lowering the costs of testing and initial treatment, lowering the lifetime costs of medical care, lowering the risk of death from testing and initial treatment, and thus modestly improving life expectancy.

CRD COMMENTARY - Selection of comparators
The reasons for the choice of the comparators is clear and justified by the authors.

Validity of estimate of measure of benefit
The estimate of the measure of benefit (life expectancies) was derived from published reports of the Surveillance Epidemiology and End Results (SEER) Program and the National Center for Health Statistics, a population-based tumour registry used to estimate mortality rates and is likely to be reliable and internally valid.

Validity of estimate of costs
Adequate details of methods and sources of cost estimation were provided, but resource use was not reported separately from prices.

Other issues
The cost data from Northern California, may not be generalisable to other parts of the USA or Britain.

Source of funding
None stated.

Bibliographic details

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MeSH
Biopsy, Needle /statistics & numerical data; Bronchoscopy /statistics & numerical data; Cost Savings; Cost of Illness;