The clinical effectiveness and cost-effectiveness of computed tomography screening for lung cancer

The clinical effectiveness and cost-effectiveness of computed tomography screening for lung cancer: systematic reviews

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Executive summary

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Executive summary

Background

Screening for lung cancer has been the subject of debate for the past three decades. This has largely stemmed from the results of chest X-ray screening studies where improvements in survival were obtained but without reductions in disease-specific, or total, mortality. The debate raises two issues: the design of studies to evaluate screening for lung cancer, in particular the choice of comparator; and the potential role of over-diagnosis of well-differentiated, slow-growing tumours that would not have led to symptoms or death in the lifetime of the affected patient.

Lung cancer is the leading cause of death from cancer in the UK, killing approximately 34,000 people per year. By the time symptoms develop, the tumour is often at an advanced stage and the prognosis is bleak. Treatment at a less advanced stage of disease with surgical resection has been shown to substantially reduce mortality. Screening would be attractive if it could detect presymptomatic lung cancer at a stage when surgical intervention is feasible.

Objectives

The aim of this review is to examine the clinical and cost-effectiveness of screening for lung cancer using computed tomography (CT) to assist policy making and to clarify research needs.

Methods

Search strategy

Fifteen electronic databases and Internet resources were searched from 1994 until December 2004/January 2005. In addition, bibliographies of the retrieved articles were searched and the register of projects held by the International Network of Agencies for HTA (INAHTA) was also checked.

Inclusion/exclusion criteria

Studies were included where screening for lung cancer was the principal theme of the paper. The initial search was for randomised trials in which survival in a group receiving CT screening was compared with a group not screened, but because of the lack of such studies, no restriction was placed on study type. Studies were reviewed by two authors independently.

Data extraction

Data extraction included details of the screening protocol, follow-up, diagnosis and participants. Information was sought about test characteristics, including sensitivity and specificity. The checklists and methods described in NHS Centre for Reviews and Dissemination (CRD) Report 4 were used for the quality assessment of studies.

Analysis

Separate narrative summaries were performed for the clinical effectiveness and cost-effectiveness. Cost-effectiveness analysis resulting in a cost per quality-adjusted life-year was not feasible, therefore the main elements of such an appraisal were summarised and the key issues relating to the existing evidence base were discussed.

Results

Summary of clinical effectiveness

In total, 12 studies of CT screening for lung cancer were identified, including two randomised controlled trials (RCTs) and ten studies of screening without comparator groups. The quality of reporting of these studies was variable, but the overall quality was adequate. The two RCTs were of short duration (1 year) and therefore there was currently no evidence that screening improves survival or reduces mortality. The proportion of people with abnormal CT findings varied widely between studies (5–51%). The prevalence of lung cancer detected was between 0.4 and 3.2% (number need to screen to detect one lung cancer = 31–249). Incidence rates of lung cancer were lower (0.1–1% per year). Detection of stage I and resectable tumours was high, 100% in some studies. Adverse events, as a result of investigation or surgery, or the screening process per se were poorly reported. Incidental findings of other abnormalities requiring medical follow-up were reported to be as high as 49%.

Summary of cost-effectiveness

Six full economic evaluations of population CT screening programmes for lung cancer were included in the review. The magnitude of cost-effectiveness ratios reported vary widely. None was set in the UK and generalisation was complicated by wide variation in the data used in different countries and a paucity of UK data for comparison. All six made the fundamental assumption that screening with CT for lung cancer reduced mortality. At the current time, there is no evidence to support that assumption.

Economic appraisal

In the absence of evidence of health gains from screening for lung cancer, in terms of either quantity or quality of life, and faced with a range of uncertainties, from the frequency of abnormal screening findings within a population to the natural history of screening detected lung cancers, it is not feasible at the current time to develop accurately and meaningfully an economic argument for CT screening for lung cancer in the UK. For subgroups, in particular certain occupational groups, there is evidence of increased risk of lung cancer, but the role of screening has not been demonstrated by the current studies.

Conclusions

The accepted National Screening Committee criteria are not currently met, with no RCTs, no evidence to support clinical effectiveness and no evidence of cost-effectiveness.

Recommendations for research

In terms of what information is needed to assist decision-making about CT screening for lung cancer, the following research priorities were identified.

- RCT evidence is needed about the effect of CT screening on mortality, either with whole-population screening or for particular subgroups. One such trial is underway in the USA, recruiting 50,000 participants, and is due to end in 2009, although final follow-up will not complete until around 2014.
- UK data about the rate of positive screening with CT and detected lung cancers could be obtained from an RCT or a cohort study. Even relatively small-scale studies would provide valuable information when trying to assess the generalisability of RCT data currently being conducted elsewhere.
- There is a need to understand better the natural history and epidemiology of screening-detected lung cancers, particularly small, well-differentiated adenocarcinomas. This could be met, in part, by lung cancer screening RCTs or cohort studies, but a review of existing published epidemiological and pathological data, along with primary analysis of UK lung cancer epidemiology, would usefully inform current understanding.
- Information about the quality of life impact of CT screening, acceptability of screening, and uptake and retention rates in the UK would be valuable in any future assessment of the cost-effectiveness of screening in the UK.
- Increased collection is needed of UK health service data regarding resource use and safety data for lung cancer management and services.
- Research is needed into the feasibility and logistics of tracing people who have in the past worked in industry where there was exposure to lung carcinogens.

Publication

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NHS R&D HTA Programme

The research findings from the NHS R&D Health Technology Assessment (HTA) Programme directly influence key decision-making bodies such as the National Institute for Health and Clinical Excellence (NICE) and the National Screening Committee (NSC) who rely on HTA outputs to help raise standards of care. HTA findings also help to improve the quality of the service in the NHS indirectly in that they form a key component of the 'National Knowledge Service' that is being developed to improve the evidence of clinical practice throughout the NHS.

The HTA Programme was set up in 1993. Its role is to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined to include all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care, rather than settings of care.

The HTA Programme commissions research only on topics where it has identified key gaps in the evidence needed by the NHS. Suggestions for topics are actively sought from people working in the NHS, the public, service-users groups and professional bodies such as Royal Colleges and NHS Trusts.

Research suggestions are carefully considered by panels of independent experts (including service users) whose advice results in a ranked list of recommended research priorities. The HTA Programme then commissions the research team best suited to undertake the work, in the manner most appropriate to find the relevant answers. Some projects may take only months, others need several years to answer the research questions adequately. They may involve synthesising existing evidence or conducting a trial to produce new evidence where none currently exists.

Additionally, through its Technology Assessment Report (TAR) call-off contract, the HTA Programme is able to commission bespoke reports, principally for NICE, but also for other policy customers, such as a National Clinical Director. TARs bring together evidence on key aspects of the use of specific technologies and usually have to be completed within a short time period.

Criteria for inclusion in the HTA monograph series
Reports are published in the HTA monograph series if (1) they have resulted from work commissioned for the HTA Programme, and (2) they are of a sufficiently high scientific quality as assessed by the referees and editors.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

The research reported in this monograph was commissioned by the HTA Programme as project number 04/41/01. The contractual start date was in September 2004. The draft report began editorial review in March 2005 and was accepted for publication in July 2005. As the funder, by devising a commissioning brief, the HTA Programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

The views expressed in this publication are those of the authors and not necessarily those of the HTA Programme or the Department of Health.

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