Cost-effectiveness analysis of stereotactic body radiotherapy and radiofrequency ablation for medically inoperable, early-stage non-small cell lung cancer

Sher DJ, Wee JO, Punglia RS

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 study estimated the relative cost-effectiveness of alternative techniques for management of medically inoperable Stage I non-small cell lung cancer in older (65 years) males. The authors concluded that compared with three-dimensional conformal radiation therapy and radiofrequency ablation, stereotactic body radiotherapy was the most cost-effective treatment in this study setting. The methodology was appropriate. The results were reported adequately. Some of the methods were not well reported. The authors’ conclusions appear appropriate.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
The objective of the study was to estimate the relative cost-effectiveness of alternative techniques for the management of medically inoperable Stage I non-small cell lung cancer in older (65 years) males.

Interventions
Two interventions were compared with the standard management of medically inoperable Stage I non-small cell lung cancer, fractionated three-dimensional conformal radiation therapy (3D-CRT). The interventions were: stereotactic body radiotherapy (SBRT) three to five sessions of very high doses (12 to 18 Gy per fraction) of irradiation; and radiofrequency ablation single-day therapy that thermally ablates small peripheral tumours.

Location/setting
USA/Secondary care

Methods
Analytical approach:
A decision-analytic state transition Markov model was used to synthesise data from several studies identified from the published literature. The time horizon of the analysis was a lifetime time horizon. The study perspective was that of the payer (Medicare).

Effectiveness data:
Effectiveness data were derived from published studies and included a long-term follow-up study from a phase II trial and long-term observational studies. The main clinical effectiveness estimates were local control and recurrence rates of cancer derived from several published studies.

Monetary benefit and utility valuations:
Utility valuations were taken from a single study from the published literature that elicited utility values from patients with non-small cell lung cancer.

Measure of benefit:
Quality adjusted life years (QALYs) discounted at an annual rate of 3%.

Cost data:
Costs of events following treatment with SBRT, radiofrequency ablation or 3D-CRT and included the cost of treatment
for pneumothorax, pneumonitis and chest wall pain, cost of chest CT (computed tomography) scans, palliative care and non-cancer end-of-life care. Resource use and prices were based on 2009 Medicare schedules, a published Medicare based study, the Red Book and Diagnosis Related Group reimbursement. Costs were presented in 2009 US Dollars ($) and discounted at an annual rate of 3%.

Analysis of uncertainty:
One-way, two-way and probabilistic sensitivity analysis were undertaken. Results were presented in tables and a cost-effectiveness acceptability curve.

Results
Mean QALYs associated with 3D-CRT management were 1.53 compared with 1.45 QALYs for radiofrequency ablation and 1.91 QALYs for SBRT.

Mean cost estimates were $48,842 for 3D-CRT, $44,648 for radiofrequency ablation and $53,133 for SBRT.

The incremental cost-effectiveness ratio of radiofrequency ablation compared with 3D-CRT was $52,400 per QALY.
The incremental cost-effectiveness ratio of SBRT compared with 3D-CRT was $6,000 per QALY.

The incremental cost-effectiveness ratio of SBRT compared with radiofrequency ablation was $14,100 per QALY.

One-way and two-way sensitivity analyses found the results to be robust to changes in the input parameters. Probabilistic sensitivity analysis estimated that the probability that SBRT was cost-effective at a societal level of willingness to pay of $50,000 per QALY was 70%.

Authors’ conclusions
The authors concluded that in comparison with 3D-CRT and radiofrequency ablation SBRT was the most cost-effective treatment for medically inoperable Stage I non-small cell lung cancer in this study setting.

CRD commentary
Interventions:
The interventions were adequately described and appeared relevant to the study setting. Current practice was appropriately included as a comparator. It appeared that the interventions were generalisable to other settings.

Effectiveness/benefits:
The methods used to identify relevant studies and select studies from those identified were not described, so it was unclear whether the best available sources of evidence were used. The methods used to derive the clinical estimates used in the economic evaluation were not detailed. The sources of evidence appeared relevant to the study setting and were presented clearly in a table with references.

The instrument used to elicit utility values in the study of patients with non-small cell lung cancer was not provided and so the methodology to support calculation of quality-adjusted life years (QALYs) was unclear. Use of QALYs as a benefit measures appeared appropriate as it incorporated both morbidity and mortality.

Costs:
The study perspective was stated clearly and the cost categories appeared to appropriately capture this perspective. The included cost data appeared appropriate and of good quality. How resource use was estimated within the study and the sources of evidence for these estimates were unclear. The costs appear to have been appropriately discounted and adjusted for inflation.

Analysis and results:
The analytical approach appeared appropriate. The model was described adequately. A graphical depiction was provided. The methods used to validate the model against published literature were presented clearly. The use of an incremental approach was appropriate to estimate the relative cost-effectiveness of the different management strategies based on the available evidence. Rigorous and comprehensive methods to assess the impact of uncertainty on results were used and were likely to give a good indication of the impact of both input and overall model uncertainty. The
results were reported adequately. The authors discussed some limitations of their study.

Concluding remarks:
The methodology was appropriate and the results were adequately reported. Some of the methods were not well reported. The authors' conclusions appear appropriate.

Bibliographic details

PubMedID
21300476

DOI
10.1016/j.ijrobp.2010.10.074

Original Paper URL

Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Carcinoma, Non-Small-Cell Lung /mortality /pathology /surgery; Catheter Ablation /economics; Cost-Benefit Analysis; Disease Progression; Frail Elderly; Humans; Lung Neoplasms /mortality /pathology /surgery; Male; Markov Chains; Neoplasm Staging; Quality-Adjusted Life Years; Radiosurgery /economics; Radiotherapy, Conformal /economics; Survival Rate; Tumor Burden

AccessionNumber
22012000026

Date bibliographic record published
24/02/2012

Date abstract record published
22/05/2012