The cost effectiveness of 3D conformal radiation therapy compared with conventional techniques for patients with clinically localized prostate cancer

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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
3D conformal radiation therapy (3DCRT) for clinically localised prostate cancer.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was elderly males (median age: 71) with clinically localised prostate cancer.

Setting
Tertiary care centre. The economic study was carried out in Philadelphia, USA.

Dates to which data relate
Effectiveness and resource use data were collected as part of the clinical study between October 1987 and November 1991. Price and cost data were taken from a 1998 source.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
Prospective costing was undertaken on both the study sample of patients, and additionally, on a separate matched case/control study group of 28 3DCRT and 28 CRT patients.

Study sample
Power calculations were not used to determine sample size. Patients were entered into the study once metastatic disease had been excluded by numerous diagnostic tests. The study sample appears appropriate for the study question. 88 patients were treated with conventional CRT and 105 with 3DCRT. Numbers of refusals and/or exclusions were not reported.

Study design
The study is a single-centre non-randomised trial with concurrent controls. The mechanism by which patients were
allocated to either arm of the study is not reported. The median follow-up was 72 months (range: 3 - 118). Loss to follow-up was not reported.

**Analysis of effectiveness**

It was not stated whether the analysis was based on a treatment completion or intention to treat basis. The primary health outcome is biochemical disease-free survival (bNED) at five years. Actuarial survival curves were calculated using Kaplan-Meier estimates.

**Effectiveness results**

53% of the 3DCRT cohort were ‘biochemically disease free’ at five years compared with 41% of the CRT cohort, (p=0.03). However, 40% of the 3DCRT cohort were ‘at risk’ at five years compared with 24% of the CRT cohort.

Stratification of the results by pre-treatment PSA, Gleason score or T-stage produced no statistically significant differences. However, this may be due to small patient numbers in each stratum.

**Clinical conclusions**

Due to the higher doses of radiation possible with 3DCRT, bNED control is significantly improved at five years compared with conventional CRT.

**Modelling**

The Lin method of estimating medical charges was used to compare mean total costs between the two arms of the study. This method breaks the time period of observation into eight one-year intervals. For each interval, the mean cost of non-surviving patients is calculated. This cost is multiplied by the Kaplan-Meier estimate of the probability of dying that year. Summing all eight intervals yields the mean total charge (MTC) for that arm. Comparisons between groups are made using Lin’s asymptotic variance estimator.

**Measure of benefits used in the economic analysis**

A cost-consequences analysis was performed, thus there was no summary measure of health benefit.

**Direct costs**

Quantities and costs were not reported separately. The costs included were most relevant to a health service or health care payer. The included costs were for pre-treatment consultations, laboratory and radiographic studies (including bone scans, plain films, computed tomography and magnetic resonance imaging), and prostate biopsy. Treatment costs included conventional and CT simulation charges, use of contract, physics and dosimetry charges, number of treatment fields and number of radiation fractions. Follow-up costs consisted of the number of physician visits (set at 15 minutes each), laboratory and radiographic studies, cystoscopy, colonoscopy, hormone therapy (either with orchiectomy or medication), and additional radiation.

All costs were taken from the 1998 Medicare fee schedule, and the Lin method of estimating medical charges was used to compare costs between the groups. As follow-up costs were estimated over a period of several years, costs should have been discounted. However, there is no evidence that this was done. The study reported mean total cost (MTC) per patient. 1998 price data were used.

**Statistical analysis of costs**

The authors used the Lin method for calculating medical charges. Lin’s asymptotic variance estimator was used to test for a significant difference between mean total costs.
Indirect Costs
Not applicable.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was performed.

Estimated benefits used in the economic analysis
Please refer to the effectiveness results reported earlier.

Cost results
The mean total cost of 3DCRT was $8,955.48 and the mean total cost of conventional CRT was $10,544.53. According to Lin's asymptotic variance estimator, this difference was not statistically significant, \( p=0.46 \).

For 3DCRT patients, the median cost of pre-treatment workup was $1,631.39 (range: $587.97 - $9,530.87) and the median cost of treatment was $10,277.08 (range: $8,967.63 - $10,851.40). For conventional CRT patients, the median cost of pre-treatment workup was $1,246.23 (range: $850.06 - $15,231.90) and the median cost of treatment was $9,026.27 (range: $7,571.41 - $10,381.36).

In the matched case-control comparison groups, the median charge for the 3DCRT group was $13,363 (range: $12,179 - $36,187). In the conventional CRT group, the median cost was $12,413 (range: $10,108 - $34,389). These differences were not significantly different, \( p=0.1428 \).

Synthesis of costs and benefits
Not applicable.

Authors' conclusions
Initial work-up costs of 3DCRT were greater than for conventional CRT, but due to a lower incidence of future events with 3DCRT, the mean total costs of treatment were not significantly different from each other. The authors predicted that 3DCRT would appear less expensive than conventional CRT with a longer follow-up period.

CRD COMMENTARY - Selection of comparators
The comparator used appears to represent current practice in the authors' setting. You, the user of the database, should decide if the comparator represents current practice in your own setting.

Validity of estimate of measure of effectiveness
The analysis was based on a non-randomised controlled trial. A randomised controlled trial would have been preferable to answer the study question, as it is not possible to rule out selection bias in explaining the results of the study. The study sample was representative of the study population, and the patient groups were largely comparable at analysis.

Validity of estimate of measure of benefit
The authors did not derive a measure of health benefit; therefore, the analysis is categorised as a cost-consequences study.
Validity of estimate of costs
All categories of cost relevant to a hospital or healthcare payer were included. However, it is unclear whether all relevant cost items were included. For example, the precise "laboratory and radiographic studies" used are unspecified. This limits the generalisability of the study to other settings. Costs and quantities were not reported separately.

No statistical analysis of quantities or sensitivity analysis of prices was performed. The authors stated that Medicare charges were used to proxy costs as "complete cost information was unavailable for all patients during the time period of the study (and) actual treatment cost was not determined”.

Costs incurred after the first year were not discounted. This may impact the results as the authors reported a heavy loading of costs in the conventional CRT arm in later years of follow-up due to relapse events. A discounted analysis would place less weight on these future events and possibly result in conventional CRT appearing less costly than 3DCRT.

Other issues
The authors made appropriate comparisons of their results with those from other studies, although the issue of generalisability to other settings was not addressed. The authors' presentation of cost results was unclear, as costs and quantities were not reported separately. The conclusions of the study reflect the scope of the analysis.

Implications of the study
3DCRT was more effective and no more expensive than conventional CRT.

Source of funding
None stated.

Bibliographic details

PubMedID
10613316

Original Paper URL
http://www.sciencedirect.com/science?_ob=ArticleURL&amp;_udi=B6T7X-3Y3PW02-P
&_coverDate=12%2F01%2F1999&_alid=65720361&_rdoc=1&_fmt=&_orig=search&_qd=1&_cdi=5070&_sort=d&wchp=dGLbVlb-lSzBS&-_acct=C000010338&_version=1&_urlVersion=0&_userid=126317&md5=9841989

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Indexing Status
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MeSH
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AccessionNumber
22000000086

Date bibliographic record published
30/11/2002

Date abstract record published
30/11/2002