Cost-effectiveness of staging computed tomography of the chest in patients with T2 soft tissue sarcomas


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
The use of chest computed tomography (CT) scanning as part of the staging evaluation for patients with T2 soft tissue sarcoma (STS). CT was performed either routinely (rCT) or selectively (sCT) in addition to chest X-ray (CXR).

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with primary, non-recurrent STS measuring more than 5 cm in its greatest dimension (T2). Patients with primary tumours of the thorax or chest wall, with histological sub-types known to have a low risk for metastatic spread (specifically desmoid tumours and dermatofibrosarcoma protuberans), were excluded.

Setting
The setting was a hospital. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were gathered from 24 June 1996 to 30 September 1999. The dates during which the resource use data were collected were not reported. The price year was 1999.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was not carried out on the same sample of patients as that used in the effectiveness study.

Study sample
Of the 699 initially identified patients, 99 were excluded because they did not meet all of the eligibility criteria, or did not undergo both a CRX and CT scan. Thus, a final sample of 600 patients was considered. There were 310 men and 290 women (52% versus 48%, respectively). The median age was 53 years (range: 16 - 88). In terms of tumour grade, 99 patients had low-grade disease, 87 had intermediate-grade disease, and 414 had high-grade disease.
Study design
A single cohort of patients who underwent both diagnostic procedures was used in the analysis. This was a case series of patients, where cases were prospectively identified at the University of Texas M D Anderson Cancer Center's Multidisciplinary Sarcoma Center. Different CT approaches were used. The follow-up data were not reported.

Analysis of effectiveness
The outcome measure used in the analysis was the yield of each CT approach. This was defined as the number of patients with pulmonary metastases divided by the number of patients going through the diagnostic strategy. Different sub-groups of patients were considered, according to histological grade (low, intermediate, high), anatomic site (extremity or retroperitoneum) and extremity tumour size (5.1 to 10 cm, or >10 cm). The impact of patient demographics, tumour location, tumour size and tumour grade on the yield of each approach was investigated.

Effectiveness results
The clinical yields with rCT and sCT were, respectively:

19.2% and 16% in the whole group of patients,
6% and 5% in patients with low-grade disease;
11.5% and 9.2% in patients with intermediate-grade disease;
23.9% and 20% in patients with high-grade disease;
21.9% and 16.7% in patients with disease located in the extremity;
13.3% and 11.6% in patients with cancer in the retroperitoneum;
18.9% and 15.4% in cancer with an extremity tumour size between 5.1 and 10 cm; and
27.7% and 19.3% in patients with an extremity tumour size >10 cm.

Demographic and tumour-specific characteristics did not affect the final effectiveness estimates.

Clinical conclusions
The diagnostic yield of the two approaches was used to populate the decision model.

Modelling
A standard decision tree was constructed to assess costs and outcomes associated with rCT and sCT. In the rCT arm, all patients would undergo chest CT scans, with positive, negative, or indeterminate results possible. For positive or negative chest CT findings, no further imaging would be required to complete the pulmonary staging assessment. However, for patients with indeterminate initial chest CT findings, chest CT scans would be repeated at 3 months and could be either positive or negative for metastatic disease. In the sCT arm, it was assumed that patients who had CXR results showing metastatic disease would undergo chest CT scanning. Patients with negative CXR results would undergo no further imaging. Patients with indeterminate CXR results would undergo chest CT scanning, which could be positive, negative, or indeterminate. Patients with positive or negative chest CT results would undergo no further imaging, whereas those with indeterminate CT results would undergo follow-up chest CT scanning at 3 months.

Measure of benefits used in the economic analysis
The summary benefit measure used was the diagnostic yield of the two strategies. This was derived from the effectiveness study.
Direct costs
Discounting was not relevant since the costs were incurred during a short timeframe. The unit costs of CXR and CT were reported. The economic evaluation considered only the costs of the two diagnostic strategies, which were evaluated using a modelling approach. The total costs included both variable and fixed items, although a detailed breakdown of the costs was not provided. Resource use was estimated on the basis of the assumed pathways of the two diagnostic strategies. Costs, not charges (as the authors stressed), were derived using computer software and relied on information from a general ledger. The cost/resource boundary was not explicitly reported, but it might have been that of the hospital. All of the costs were adjusted to 1999 values using the medical component of the Consumer Price Index.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not considered.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were carried out to examine the robustness of the estimated cost-effectiveness ratios to variations in some model inputs. In the one-way sensitivity analysis, the cost and sensitivity of chest CT scanning were varied. In the two-way sensitivity analysis, chest CT scanning cost was varied across different tumour grade sub-groups.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
In the whole group of patients, the cost per patient was $1,301 with rCT and $418 with sCT.

The cost per patient of the two strategies varied very slightly for all sub-groups of patients. rCT was more expensive than sCT in all cases.

Synthesis of costs and benefits
An incremental cost-effectiveness ratio (ICER), that is, the incremental cost per additional patient with pulmonary metastases detected by rCT versus sCT, was calculated. The ICER was:

$27,594 in the whole group of patients,

$99,800 in patients with low-grade disease,

$41,565 in patients with intermediate-grade disease,

$21,538 in patients with high-grade disease,

$18,135 in patients with disease located in the extremity,

$52,588 in patients with cancer in the retroperitoneum,
$27,200 in cancer with an extremity tumour size between 5.1 and 10 cm, and $12,524 in patients with an extremity tumour size >10 cm.

The univariate sensitivity analysis showed that the ICER improved as the cost of CT decreased or the sensitivity of CT increased, in line with expectations.

The two-way sensitivity analysis showed that as the hypothetical cost of chest CT scanning was reduced for each tumour grade, the ICER declined progressively.

For hypothetical chest CT scanning costs of $201, $221 and $242 in patients with low-, intermediate- and high-grade tumours, respectively, rCT was no longer the more expensive option.

**Authors' conclusions**

For patients with T2 soft tissue sarcoma (STS), routine computed tomography (rCT) was most cost-effective in patients with high-grade disease (at any site) or disease arising in an extremity. However, selective computed tomography (sCT) was not cost-effective in patients with low-grade or retroperitoneal STS.

**CRD COMMENTARY - Selection of comparators**

The selection of the comparators was appropriate as it reflected the two possible uses of CT scans for the staging of T2 STS. You should decide whether they are valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**

The effectiveness evidence came from a large group of patients who were identified at a single institution. The authors did not report the details of the assessment methods. No information on follow-up was provided. Overall, case series represent weak sources of evidence, as no explicit control group is considered. Further, the impact of bias and confounding was not taken into consideration in the analysis. The sensitivity of CT was varied in the sensitivity analysis.

**Validity of estimate of measure of benefit**

The benefit measure used in the analysis is not easily compared with the benefits of other health care interventions. The authors noted that similar studies had used the number of patients detected, although such a measure is difficult to interpret and judge. The use of long-term data would allow the measurement of years of life saved, which represents a more appropriate benefit measure.

**Validity of estimate of costs**

The perspective adopted in the study was not stated clearly. Only the costs strictly related to the performance of the diagnostic test were considered in the analysis. A detailed breakdown of items was not provided. The costs associated with further treatment were not incorporated into the analysis because it was assumed that such costs could be comparable for the two strategies. Resource use was based on the hypothetical diagnostic pattern considered in the decision model. The price year was reported, which aids reflation exercises. The authors stressed that true cost data were used. These are less prone than charges to bias due to different payer profit margins. The cost of CT was varied in the sensitivity analysis, which was used to extrapolate the results of the analysis to settings with different costs.

**Other issues**

The authors did not make extensive comparisons of their findings with those from other studies. The issue of the generalisability of the study results to other settings was not explicitly addressed, although the use of a sensitivity analysis enhanced the external validity of the analysis. The authors noted that the lack of uniform CT protocol could have represented a limitation of the study. However, the study reflected real-world diagnostic patterns, where different protocols are generally used.
Implications of the study
The study results did not support the current consensus-based guidelines for staging of T2 STS. The authors stressed that further studies should examine subsequent treatment and outcomes in patients with synchronous lung metastases in order to facilitate a more evidence-based approach to STS staging.

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None stated.

Bibliographic details

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Other publications of related interest


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