Cost-effectiveness of MRI and PET imaging for the evaluation of axillary lymph node metastases in early stage breast 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.

CRD summary
This study examined the cost-effectiveness of magnetic resonance imaging (MRI) and positron emission tomography, compared with sentinel lymph node biopsy (SLNB), for the assessment of axillary lymph node metastases, in patients with newly diagnosed, early-stage, breast cancer. Replacing SLNB with MRI was the best strategy, but if replacement strategies were excluded due to their higher rates of false-positive and -negative results, MRI before SLNB was the best alternative. The methods were valid and the authors’ conclusions are appropriate and robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of magnetic resonance imaging (MRI) and positron emission tomography (PET), compared with sentinel lymph node biopsy (SLNB), for the assessment of axillary lymph node metastases in patients with newly diagnosed, early-stage, breast cancer.

Interventions
MRI or PET were assessed with or without subsequent SLNB for node-negative patients. Axillary lymph node dissection was performed in node-positive patients.

Location/setting
UK/hospital.

Methods
Analytical approach:
The analysis was based on a discrete-event simulation, with a lifetime horizon. The authors did not explicitly state the perspective adopted.

Effectiveness data:
The clinical data came from a selection of published studies and expert opinion, where data were not available. The accuracy of the diagnostic tests was the key input for the model. A systematic review of the literature was used to identify the data on the accuracy of PET and MRI.

Monetary benefit and utility valuations:
Most of the utility estimates were from published sources. The utility decrements due to lymphoedema were from a published study that used the Functional Assessment of Cancer Therapy - Breast cancer (FACT-B) instrument.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 3.5%.

Cost data:
The economic analysis included the costs of diagnostic procedures, axillary lymph node dissection, breast surgery, seroma, surgical drains, infection, adjuvant therapy (including chemotherapy), post-adjuvant therapy, locoregional relapse, remission, metastatic relapse, and death. These costs were from NHS Reference Costs wherever possible.
otherwise, published literature was used. They were in UK pounds sterling (£) and a 3.5% annual discount rate was applied. The price year was 2007.

Analysis of uncertainty:
One-way sensitivity analyses were carried out on the following inputs: the sensitivity and specificity of MRI and PET, the utility and cost of an enlarged lymph node, the probability of relapse in false-negative patients, and the costs of SLNB. Published confidence intervals were used for most estimates. A probabilistic sensitivity analysis was undertaken, using predefined distributions for the probabilities, utilities, and costs.

Results
The projected total costs were £20,189 with SLNB, £19,325 with MRI, £19,319 with PET, £20,201 with MRI before SLNB, and £20,822 with PET before SLNB. The total QALYs were 8.119 with SLNB, 8.174 with MRI, 8.126 with PET, 8.124 with MRI before SLNB, and 8.125 with PET before SLNB.

The most cost-effective strategy was MRI alone, with a net benefit of £2,507 at a threshold of £30,000 per QALY, followed by PET alone, with a net benefit of £1,085. SLNB was dominated by these two strategies, as they were both more effective and less expensive. MRI before SLNB had a lower, but still positive, net benefit, while PET before SLNB was not cost-effective. If MRI and PET alone were excluded on a clinical basis, because they produced more false-positive and false-negative results, then the most cost-effective strategy was MRI before SLNB.

These base-case results were generally stable, except that SLNB was the best strategy when the MRI and PET alone strategies were excluded and the sensitivity of MRI was reduced.

Authors’ conclusions
The authors concluded that replacing SLNB with MRI was the best strategy, but if replacement strategies were excluded due to their higher rates of false-positive and false-negative results, then MRI before SLNB was the best alternative.

CRD commentary
Interventions:
The selection of the comparators appears to have been appropriate. The authors stated that there were two gold-standard diagnostic procedures in the UK, namely SLNB and four-node sampling; while SLNB was used in this study, an analysis of four-node sampling was presented in another publication.

Effectiveness/benefits:
No systematic literature review was reported to identify the clinical evidence. Few characteristics of the data sources were provided, except for a review of the literature, that supplied the accuracy for MRI and PET. The authors pointed out that the evidence on MRI was less robust than that on PET, and these estimates varied substantially depending on the data sources. Little evidence on the probabilities of lymphoedema was found in the literature. The utility values were from published sources and, where reported, were assessed using disease-specific instruments. QALYs were a valid benefit measure given the impact of the interventions (invasive versus non-invasive) on quality of life.

Costs:
The authors did not explicitly state the perspective adopted, but the direct medical costs appear to have been included and most of the data were from NHS sources, suggesting the selection of a health care payer perspective. The costs were presented as category totals, reflecting the typical accounting system of a national payer. Other details of the economic analysis, such as the price year and the use of discounting for long-term costs were reported. The projected costs were presented as short- and long-term costs.

Analysis and results:
The costs and benefits were appropriately synthesised, using the net benefit approach, and this was calculated for various cost-effectiveness thresholds. The results of the base case and the sensitivity analyses were clearly presented. The uncertainty was satisfactorily investigated, using various methods. The authors noted some limitations of their analysis, which have been discussed. They stated that there was high uncertainty in the results and larger and better designed studies on the accuracy of MRI and PET were needed for a more robust analysis.
Concluding remarks:
The methods were valid and well described and the authors’ conclusions are appropriate and robust.

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