Magnetic resonance imaging (MRI) for assessment of axillary lymph node metastases in breast cancer: systematic review

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INTRODUCTION

Assessment of axillary lymph node status is important in breast cancer staging. UK guidance recommends sentinel lymph node biopsy (SLNB) or 4-node sampling (4-NS) where ultrasound and ultrasonographically normal nodes are negative. Where biopsy, SLNB or 4-NS are positive, axillary lymph node dissection (ALND) is recommended. The surgical procedure ALND, and to a lesser extent SLNB and 4-NS, are associated with adverse effects such as arm lymphoedema. Magnetic resonance imaging (MRI) provides detailed images of the body in any plane and is a non-invasive technique with few adverse events. An MRI scan may provide information on whether a lymph node is suspicious for metastasis, avoiding the need for surgery and its associated adverse effects. However, it is unclear whether MRI can match the excellent diagnostic accuracies of ALND, SLNB and 4-NS.

OBJECTIVE

To assess the diagnostic accuracy and effect on patient outcomes of MRI for assessment of axillary lymph nodes in newly diagnosed early breast cancer.

METHODS

A systematic review was undertaken to identify studies reporting sensitivity and specificity of MRI for the assessment of axillary lymph node metastases in early-stage breast cancer. The following databases were searched in April 2009: MEDLINE, Embase, CINAHL, Cochrane Database of Systematic Reviews, Cochrane CENTRAL, Register of Controlled Trials, DARE, NHS EED, HTA database, Science Citation Index, and BIOSIS previews. Research registers and conference proceedings were also searched. Articles were considered for inclusion by two reviewers and were included in the review if they met the inclusion criteria (Table 1). Data were extracted by one reviewer using a standardised data extraction form and checked by a second reviewer. Discrepancies were resolved by discussion. Study quality was assessed using the QUADAS checklist (Quality Assessment of Diagnostic Accuracy Studies).1 A bivariate random effects approach was used for the meta-analysis of pairs of sensitivity and specificity to allow for the observed inverse relationship between the two.

RESULTS

The diagnostic accuracy data was analysed according to the criteria for defining whether axillary metastases were present. The use of contrast uptake pattern as the main criterion for defining a node as metastatic appeared to give better combined sensitivity and specificity than size and morphology, although many studies used criteria based on both uptake and size/morphology, and the methods of interpreting uptake patterns varied within and between studies. Sensitivity analyses were performed where data allowed. A non-significant trend towards higher sensitivity and significantly lower specificity was observed where all patients were newly diagnosed and early stage. Study quality and prevalence of metastases did not affect results, though study quality was largely homogenous making for a limited analysis. Only mild to moderate adverse events were reported, including back pain and claustrophobia whilst in the scanner, and allergic reactions (rash) to the contrast media USPIO.

CONCLUSIONS

Compared to reported values for SLNB and 4-NS (sensitivity approximately 93–95%, specificity 100%10–12), USPIO-enhanced MRI showed higher sensitivity but lower specificity, gadolinium-enhanced MRI showed lower sensitivity and specificity,3 and 4-NS was 100% sensitive and specific for axillary metastases. Although MRI was found to be non-invasive and to have minimal adverse effects, it was not as sensitive as ALND and SLNB. Further studies are required to confirm whether USPIO-enhanced MRI might be used in the clinical setting as an alternative assessment tool in breast cancer.

Table 1. Inclusion criteria

| Population | 50% or more newly diagnosed early stage breast cancer (TNM stage 1, 2, or 3A)11
| Diagnostic test | Diagnostic tests utilising MRI technology
| Reference standard | ALND, SLNB or 4NS
| Outcome | Sensitivity and specificity of MRI for assessment of axillary metastases
| Study design | Cohort studies from which true positive, false positive, true negative and false negative numbers could be extracted or calculated

Table 2. Study and patient characteristics

| Study | Year | Age range (years) | N (patients) | Female (%) | TNM stage | Histology (no. of patients) | MRI technology | Imaging type | Sensitivity (% (95% CI)) | Specificity (% (95% CI)) | Other test | Risk of bias and validity
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REFERENCES


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