Accuracy and surgical impact of magnetic resonance imaging in breast cancer staging: systematic review and meta-analysis in detection of multifocal and multicentric cancer

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CRD summary
This review concluded that MRI staging caused more extensive breast surgery in an important proportion of women due to identification of additional cancer; there was a need to reduce the incidence of false positives in such detection. These conclusions appeared reasonable, but the limited search and non-ideal screening process should be borne in mind when assessing their reliability.

Authors' objectives
To determine the accuracy and impact on treatment of magnetic resonance imaging (MRI) in staging of breast cancer.

Searching
MEDLINE was searched from 1966 to June 2007. Search terms were reported. References of primary studies and reviews were checked.

Study selection
Studies that assessed MRI detection or accuracy in local staging of women with proven or suspected breast cancer were eligible for inclusion. Studies were required to report a measure of MRI accuracy for detection of additional tumour foci other than the index cancer. Data on foci not detected on baseline clinical and imaging MRI or that permitted reliable calculation of MRI-only detection were required. Also required was a minimum of reporting of true and false positives and data that could be reliably distinguished from the index cancer. The reference standard was histological confirmation of the presence or absence of multifocal or multicentric cancer. The quality of the reference standard was classified from most adequate (mastectomy with serial sectioning in all breasts) to least adequate where data on mastectomy, excision or wide local excision histology were not reported for all patients.

Studies of both suspected and confirmed cancer were included. Mean age ranging from 48.7 to 60 years (where reported).

Studies were selected by one reviewer. Two reviewers independently scrutinised the included studies.

Assessment of study quality
Validity was assessed using criteria adapted from a standard tool for studies of test accuracy. Study characteristics that included diagnostic criteria and criteria related to test accuracy (such as inclusion of consecutive patients and consistent use of an appropriate reference standard) were used in the assessment.

It appeared that two reviewers independently performed the assessment.

Data extraction
Data to permit the construction of 2x2 tables were extracted. Where possible, data were also extracted on actual or potential (not theoretical) changes to surgical management attributed to MRI detection. Data on detection of multifocal or multicentric cancer on baseline assessment were removed from studies that reported any MRI assessment. Authors were contacted for additional data where necessary. Sensitivity, specificity, positive predictive value and true positive/false positive ratios with 95% confidence intervals (CI) were calculated for each study. Where false negative rates were not reported these were assumed to be zero.

by one reviewer and checked by a second. Disagreements were resolved by consensus or consultation with a third reviewer.
Methods of synthesis
A hierarchical summary receiver operating curve (SROC) was used to pool data on the accuracy of MRI. The area under the curve and diagnostic odds ratio were calculated with 95% confidence intervals. Random-effects model logistic regression was used to assess whether the positive predictive value in a study was associated with design, quality criteria or defined study entry. Random-effects logistic regression was used to calculate a summary estimate for the proportion of surgery alteration attributed to MRI detection of additional foci.

Results of the review
Nineteen studies (n=2,610 participants) were included in the review. Ten studies were prospective, seven were retrospective and two studies did not report design. Seven studies reported consecutive enrolment of patients.

Prevalence of detection of additional foci in the ipsilateral breast ranged from 6% to 34% (median 16%, interquartile range 11% to 24%). The estimated SROC gave a diagnostic odds ratio of 189 (95% CI 59 to 601) and an area under the curve of 98%. When the five studies with an assumed false negative rate of zero were removed from the analysis, the diagnostic odds ratio was 88 (95% CI 30 to 259) and the area under the curve was 96%. There was a statistically significant inverse relationship between the incremental accuracy of MRI and the quality of the reference standard (p=0.016). Positive predictive value ranged from 0.19 to 1.0 with an overall estimate of 0.66 (95% CI 0.52 to 0.77).

Rate of conversion from wide local excision to mastectomy was 8.1% (95% CI 5.9 to 11.3) and from wide local excision to more extensive surgery was 11.3% (95% CI 6.8 to 18.3). Changes in management as a result of MRI false positives were 1.1% (95% CI 0.3 to 3.6) and 5.5% (95% CI 3.1 to 9.5).

Authors’ conclusions
MRI staging caused more extensive breast surgery in an important proportion of women due to identification of additional cancer, but there was a need to reduce the incidence of false positives in such detection.

CRD commentary
The review question and the inclusion criteria were clear. Only one database was searched, which increased the chances that relevant studies were omitted from the review. The authors reported that they used methods designed to reduce reviewer bias and error at each stage of the review process. But most of the screening of studies for inclusion was conducted by only one reviewer, which increased risks of error and bias. The validity assessment employed relevant criteria and was used to inform the synthesis. Use of hierarchical SROC to pool studies appeared reasonable. Use of the quality of the reference standard to investigate heterogeneity between studies was appropriate. Pooling of the rates of conversion of surgical management was reasonable.

The authors’ conclusions appeared reasonable, but the limited search and limitations of the screening process should be borne in mind when assessing their reliability.

Implications of the review for practice and research
Practice: The authors stated that clinicians should inform women who were considering MRI staging of breast cancer of the reported estimates for detection and alteration of surgical care.

Research: The authors stated that randomised trials were needed to determine the value of detection of additional disease that altered the surgical management of women with apparently localised breast cancer. The impact of MRI on surgical and any adjuvant therapy should be assessed. Trials should monitor immediate and long-term clinically relevant end points that should include psychological impact. Clinician and patient views of the differential trade-off between true and false positives and their sequelae should be assessed.

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