MRI screening for breast cancer in genetically high-risk women


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Citation

Authors' conclusions
The current “gold standard” for breast cancer screening in Australia is mammography, which is offered free to all Australian women 40 years and over, by BreastScreen Australia. Mammography involves exposing the patient to radiation, which may represent a risk in women with a genetic pre-disposition to breast cancer. On a mammogram of normal breast tissue, fat will appear as grey and the denser breast tissue as white. Mammography has been demonstrated to be insensitive in the presence of dense breast tissue. Abnormalities are easier to identify in older, post-menopausal women who will have proportionally greater amounts of fat. The participation rate in the Breast Screen Australia program, for the target group of 50-69 year olds, is 57 per cent of eligible Australian women. Australian women have an approximate lifetime risk of one in eleven of developing breast cancer before the age of 75 years.

MR imaging of breast tissue, utilising contrast enhancement agents, has been in use since the mid 1980s. Malignant tissue tends to be highly vascularised when compared to benign or normal tissue. MRI, in conjunction with the injection of contrast dyes, is able to visualise highly vascularised regions, and in so doing may differentiate between benign and malignant tissue. MRI does not use ionising radiation and is not affected by the density of breast tissue.

MRI may be of particular use as a breast screening modality in women considered to be at high-risk of developing breast cancer who tend to develop disease at a significantly younger age and are usually pre-menopausal. These women, due to their age, have high-density breast tissue and therefore are difficult to screen utilising mammography. Women considered to be at high-risk of developing breast cancer include those with a familial or personal history of breast or ovarian cancer, or women with a demonstrated germ-line mutation in a breast-cancer associated gene such as BRCA1, BRCA2 or Tp53. Breast cancers in younger patients tend to be more aggressive, high-grade and receptor negative, making early diagnosis critical. It has been estimated that the number of women considered to be at high-risk of developing breast cancer would be less than one per cent of the total female population of Australia.

The majority of cancers detected in all studies were either high grade or invasive. However, most studies did not report which screening modality detected invasive or DCIS cancers.

Of the studies assessed in this report for the effectiveness of MRI for the screening of breast cancer, six studies presented sensitivity and specificity data. Sensitivity for MRI compared to mammography ranged from 71 to 100 per cent, and 33 to 43 per cent respectively, for both asymptomatic women who did not, or may have had a previous history of breast cancer. Specificity for MRI compared to mammography ranged from 88 to 95 per cent, and 94 to 100 per cent respectively, for the same group of women. Therefore MRI appears to provide improved sensitivity when compared to mammography as a screening modality in asymptomatic high-risk women who have had no, or may have had a previous history of breast cancer.

All studies included in this assessment recruited women at high-risk of developing breast cancer who satisfied eligibility criteria such as a familial history or carrying a mutation of the known breast cancer genes. Age was not stipulated as an eligibility criteria, however the majority of women participating in these trials were young. Seven studies reported the mean age ranged from 39 (± 9) to 46 years of age. In addition, four studies reported the median age of participants ranged from 41 to 50 years of age. The poor sensitivity of mammography in these populations may be related to the young age of the women and the density of their breast tissue. One study characterised the density of breast tissue in women participating in the trial. Of the six invasive breast cancers detected in this study, four of the women were characterised as having high-density breast tissue and two as having low density. Only those women with low-density breast tissue had breast cancer detected by mammography, whereas MRI detected all six cases.

False positive rates for MRI and mammography were similar, ranging from 5 to 9 per cent and 0.5 to 7 per cent respectively. However, one study, which compared MRI only to biopsy, reported a false positive rate for MRI of 19 per...
False negative rates were significantly higher for mammography, ranging from 57 to 67 per cent, compared to a range of 0 to 4 per cent for MRI. False positive findings may result in patients undergoing unnecessary biopsies or surgery. False negative results may give false reassurance to patients that they are disease free and therefore may have serious consequences in terms of their future treatment. In addition, one study reported higher recall rates for MRI (10%) compared to mammography (4%). These patients may experience high levels of stress and anxiety while awaiting further investigation.

Currently the use of MRI as a screening modality in Australia would be limited to the availability of scanning time on available MRI scanners in public or private hospitals. MRI scanners in Australia are currently working at capacity and the introduction of a MR breast-screening program may require the purchase of additional MRIs. The UK National Health Service estimates the cost of targeted MRI screening as £350 (A$860) per patient, per annum, and a cost per cancer detected of approximately £13,700 (A$ 34,000). This compares with the current cost of population mammographic screening of between £5-8,000 (A$12-20,000) per cancer detected. Other studies indicate that the estimated cost per cancer detected using MRI as €uro13,930 (A$ 23,000) compared to €uro9,000 (A$ 15,000) for conventional mammography.

In summary, MRI appears to be of benefit in the diagnosis of women at high-risk of developing breast cancer. MRI appears to have improved sensitivity, comparable false positive rates and improved false negative rates when compared to mammography, for young, at risk women. However, the majority of studies included in this assessment have presented preliminary results of on-going screening trials. The number of rounds of screening are low for the women included in the studies and longer follow-up is required to be able to make firm conclusions. In addition, the number of breast cancers detected were small ranging from 1.6 to 17 per cent of all women enrolled. Most of the studies were conducted on relatively small numbers of women, the largest number of participants being 1,848.