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The Use of Preoperative Magnetic Resonance Imaging in the Screening and Diagnosis of Breast Cancer

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ABSTRACT

Background: Understanding the clinical applications for breast MRI that are supported by the scientific evidence is important to ensure proper use of this medical resource. The use of MRI increased from 2005 to 2008 for women with both in situ carcinoma and invasive carcinoma.

Objectives: this review aiming at assessing the evidence supporting use of MRI in the screening and diagnosis of breast cancer.

Methods: a systematic search was conducted in main databases using keywords. The relevant studies that met inclusion criteria were included in this review. The findings of the included studies were discussed in this narrative review. The protocol of this review was approved by technical and ethical committee.

Results: many studies found that breast MRI is advantageous when used to examine patients with high risk for breast cancer, assessment the ipsilateral and contralateral breasts in patients with diagnosis of new breast carcinoma, assessing patients with metastasis and unknown primary, patients monitoring with chemotherapy. When used in these clinical scenarios, high sensitivity of MRI results in early detection of cancer or greater accuracy of detection compared with existing clinical and imaging tests.

Conclusion: MRI is an excellent tool for determining the extent of tumor, and should be performed especially in the dense breasts. To avoid overestimation and to diminish false positive examinations, MRI should be performed in the second week of the menstrual cycle and after the interruption of hormonal therapy.

INTRODUCTION

Magnetic resonance imaging (MRI) is a very important tool in the armamentarium for breast imaging [(1)]. The key benefits of breast MRI are its high sensitivity for detection of breast carcinoma and the ability to depict Cancers that are vague on ultrasound, mammography, and clinical breast examination. Owing to enthusiasm for its merits, there has been a rapid increase in the use of breast MRI during the last decade [(2)]. Additional gains in use are expected given the recent recommendations by American Cancer Society (ACS) that breast cancer screening in some categories of women at high risk now include annual MRI **[(3)]**. MRI is a valuable tool for the detection and characterization of breast cancer and for the assessment of breast implant integrity. Understanding the particular clinical applications for breast MRI that are supported by the scientific evidence is important to ensure proper use of this medical resource**[(4)]**. The use of MRI increased from 2005 to 2008 for women with both in situ carcinoma and invasive carcinoma**[(2)].** This review aiming at assessing the evidence supporting use of MRI in the screening and diagnosis of breast cancer.

METHODS

The systematic search was conducted in main databases using keywords (MRI OR Magnetic Resonance Imaging) AND (Breast Cancer). The relevant studies that met inclusion criteria were included in this review. The findings of the included studies were discussed in this narrative review. The protocol of this review was approved by technical and ethical committee of **Umm Al-Qura University**.

RESULTS

Preoperative MRI evaluation of the extent of disease in the ipsilateral breast in patients with a recent cancer diagnosis has several potential benefits. Multiple studies have now demonstrated that breast MRI is advantageous when used to examine patients with high risk for breast cancer, assessment the ipsilateral and contralateral breasts in patients with diagnosis of new breast carcinoma, assessing patients with metastasis and unknown primary, patients monitoring with chemotherapy. When used in these clinical scenarios, high sensitivity of MRI results in early detection of cancer or greater accuracy of detection compared with existing clinical and imaging tests[(4)]. Cancer metastasis is an ineffective process[(5)] .

MRI is the most sensitive imaging technique to breast cancer detection[(6)]. This high rate of breast cancer detection is based on various physical principles other than those used in ultrasound and mammography [(7)].

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Lesions detected at breast MR imaging and classified as suspicious need to be sampled into biopsy for histopathological verification. Although the MRI guided biopsy is a safe and accurate diagnostic tool, its broad application is constrained by its availability, costs, and requirement for contrast medium administration[8].

Detection of invasive cancer for MR mammography, sensitivity up to 98% for invasive carcinomas have been reported, while specificity is between 65% and79% [9].

No correlation was found with tumor grade, estrogen receptor levels or family history. A higher frequency of MR detected multiple lesions was found in women with the first-degree family history of breast carcinoma or in cases of invasive lobular carcinoma[10].

DISCUSSION

Preoperative breast (MRI) utilization for women with breast cancer has been increasing substantially in the US. Preoperative MRI may improve cancer detection in assessing the extent of the tumor in ipsilateral breast [4] which may facilitate the optimal surgical plans.

It is necessary to obtain images when additional exams are performed. If the measured diameter of a lesion on MR is significantly larger than that measured on ultrasound and mammography, a biopsy of the periphery of the enhancing area has to be done before wider surgery is performed. If additional enhancing lesions cannot be localized under mammography or ultrasound, biopsy or MR-guided localization should be performed, and provide excellent accuracy. Based on the results of multiple studies, Preoperative MRI is recommended in patients with breast cancer who are planning to breast conserving surgery. Surgeons, clinicians and radiologists are increasingly interested in the true value of MRI as standard imaging technique in the daily clinical practice [1].

Using MRI in patients with newly diagnosed breast cancer requires balancing between the positive and negative aspects of additional imaging as evidenced by the increasing number of reviews and editorials that with or against routine use of MRI[11].

Although the advocates for MRI before surgery has been argued that the MRI will be able to decrease the re-excision rates. **Hwang *et al.*[12]** failed to demonstrate such improvement. This lack of benefit is thought to be related to multiple factors, such as the moderate specificity of breast MRI and the discordance of a tumor size estimate between pathology and MRI of the breast [13] or because there is no consensus between physicians about what constitutes an adequate negative resection margin as found by **Azu *et al.*[14]**. Another plausible explanation for this discrepancy could be that surgeons who tended to order preoperative breast MRI might also prefer wider negative margins than surgeons who usually did not order breast MRI. Thus, for an appropriate assessment of the relation between preoperative breast MRI and multiple surgeries, the effect of the individual physician should be considered[15].

MR imaging has shown to be useful for assessing cancer for checking patients with high risk, evaluation of patients with newly breast cancer diagnosed, monitoring of patients undergoing chemotherapy, and assessment of patients with metastasis and primary site is unknown [4]. Breast (MRI) is useful for assessing the safety of silicone implants. In addition, some have advocated the use of breast MRI as a problem-solving technique for ambiguous clinical or mammographic findings, but this application remains controversial. For each of these clinical uses, evidence will be reviewed with respect to diagnostic accuracy of MRI breast. Where there are study results for MRI efficacy based on effects on patient management or clinical outcomes, these findings presented by **Kuhl [8]**.

MRI proponents of breast implants argue that MRI best distinguishes the extent of tumor, as such as, should improve surgical planning and reduce the rate of positive surgical resection margins, thus, the need to re-excision[16]. Evaluation of silicone breast implant integrity is another evidence-based application of this imaging tool. Use of breast MRI for problem solving for equivocal clinical or mammographic findings remains controversial because there are sparse data to support this application.

MRI was suggested to have a role in early response assessment. Quantitative imaging by dynamic contrast enhanced (DCE) MRI has theoretical advantages over conventional assessment methods (mammography, ultrasound, and clinical examination) in measuring angiogenic changes in response to NAC which may occur prior to reductions in tumor size[16].The benefits of improved cancer depiction in these settings are generally sufficient to outweigh the limitations of MRI such as false positive findings reported by **DeMartini and Lehman [17]**.

Although MRI is the most sensitive way to detect breast cancer, this is tempered by imperfect specificity owing to the overlap in imaging

features of malignant and benign lesions. The diagnostic accuracy of breast magnetic resonance imaging is also dependent on the patient population studied. Thus, MRI false-positives that require additional testing with imaging follow-up or biopsy will occur, and the likelihood and impact of such findings vary based on the clinical setting in which breast MRI is performed as found by **Houssami *et al*.** [(7)]. In addition to the possibility of false-positive findings, breast MRI has limitations that include higher cost, longer examination time, and availability compared to ultrasound and mammography. Given them potential risks of breast MRI, it is important that use of this technique is confined to those groups of patients for whom there is evidence of acceptable diagnostic accuracy and knowledge that the benefits outweigh the potential risks. Use that is guided by prior studies of efficacy will optimize the clinical value of MRI breast and facilitate proper use of this medical resource. Scientific evidence currently supports the use of breast MRI for specific clinical applications [(17)].

CONCLUSION

MRI is an excellent tool for determining the extent of tumor, and should be performed especially in the dense breasts. It will influence surgical decision making. To avoid overestimation and to diminish false positive examinations, MRI should be performed in the second week of the menstrual cycle and after the interruption of hormonal therapy. Due to low specificity, it is necessary to carry out biopsy of additional lesions detected on MR, before changing the treatment planning. If additional lesions are seen on MR only, we recommend review of the mammography, and performance of additional mammography views.

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