REVIEW

The role of MRI in assessment of asymmetrical breast densities

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Abstract This study included 86 women presented with asymmetric breast densities, seen on either routine screening or diagnostic mammogram.

The aim of this work was to review the diagnostic role of breast MRI in the assessment of the clinical significance and outcomes of asymmetric breast densities identified on mammograms.

All patients underwent clinical examinations, bilateral mammography, breast ultrasonography, and MR mammography including dynamic contrast study.

Results: MRI showed asymmetric breast densities secondary to benign changes in 62 patients (72%) and malignant lesions in 24 patients (27.9%).

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1. Introduction

Asymmetric breast densities may be indicative of a developing mass, variation of normal breast tissue, or it may reflect post-operative change from a previous biopsy, hormone replacement therapy or merely poor positioning (1,2).

The American College of Radiology (ACR), Breast Imaging Reporting and Data System (BI-RADS) defined four different types of asymmetric breast findings:

1. *Asymmetric Breast tissue*: refers to a greater volume or density of breast tissue in one breast than in the corresponding area in the contra lateral breast.
2. *Densities seen in one projection*: reflect a density seen in only one mammographic projection.
3. *Architectural distortion*: refers to a focal area of breast tissue that appears distorted with no definable central mass. Speculations radiate from a common point, and there is an area of focal retraction and tethering of normal parenchyma.
4. *Focal asymmetric densities*: refer to focal asymmetric densities that are seen on two mammographic views but cannot be accurately identified as a true mass (2,3).

At the present time, conventional mammography and ultrasonography (US) are the most widely employed noninvasive screening methods for detection and evaluation of asymmetric breasts. However, these techniques may have limited sensitivity and specificity for the detection and diagnosis of breast lesions.

Digital mammography has the potential to overcome some of the limitations of conventional mammography; because of the increased contrast and decreased image noise it is possible to improve image quality (4-6).

2. Aim of the work

The aim of this study was to investigate the role of breast MRI in the evaluation of the clinical significance and outcomes of asymmetric breast densities identified on mammograms.

3. Patients and methods

This study included 86 women presented with asymmetric breast densities, seen on either routine screening or diagnostic mammogram during the period from June 2006 to June 2008. The patients’ age ranged from 24 to 67 years.

Forty eight of our patients were asymptomatic seen on routine screening, the other 38 patients were symptomatic presented with pain, discharge and/or palpable lumps.

3.1. Methods

All patients underwent clinical examinations, bilateral mammography, breast ultrasonography, and MR mammography including dynamic contrast study.

Breast MRI examinations were performed using a 1.5 T MR scanner (Signa; General Electric Medical systems).

Patients were imaged in prone position with breasts hanging dependently, within Phased array breast coil.

3.2. Examination protocol

For all patients, the following sequences were obtained:

- Localizer; axial fast spoiled gradient echo.
- Sagittal T1-weighted spin-echo imaging.
- Sagittal fast short inversion recovery sequence (STIR).
- Axial and Sagittal T2 images with fat saturation using fast spoiled gradient-echo sequence (SPGR).

4. Contrast study

Rapid bolus injection of gadolinium dimeglumine (Magnevist) was administered at a dose of 0.1 mmol/kg.

Multiphase dynamic sequences (Vibrant fast spoiled gradient echo) were acquired immediately, at 90 s, at 3 min and at 6 min after intravenous contrast injection.

Using a GE Advantage windows workstation with func Tool software for image post processing, ROI measurement of suspicious foci was performed for parametric color maps to determine the lesion enhancement rate peak and time.

Lesions that are strongly and rapidly enhancing were displayed in red, whereas slowly or weakly enhancing lesions appeared blue or green.

Automated Slope enhancement ratio curves (SER) were obtained.

Sonographically guided biopsies were performed for 53 patients with solid lesions noted on MR fine needle aspiration and cytological examination was performed for three cases. The other 30 patients were followed clinically, and Mammography or ultrasonography for 20 months.
On breast MRI suspicious malignant lesions were diagnosed on basis of the morphological features of the mass such as spiculated borders, microlobulated margins, irregular masses and breast stroma architectural distortion. Benign breast masses were diagnosed based on their morphological feature (smooth masses of wall defined borders and absence of surrounding breast stroma architectural distortion).

5. Results

Out of 86 women included in this study MRI showed asymmetric breast density secondary to benign changes in 62 patients (72%) and malignant lesions in 24 patients (27.9%) (Table 1).

5.1. Benign diagnosis (n = 62)

MRM demonstrated asymmetric densities secondary to asymmetric breast tissue size in 16 patients (18.6%) with no underlying masses or cystic changes. Mammography follow up of this group for 20 months showed no changes of the asymmetric densities and no developing masses. (Fig. 1).

Breast MRI revealed asymmetric densities secondary to benign lesions in 42 patients (48.8%); findings included fibrocystic changes in 14 patients (16.2%) (Fig. 2), in three patients complicated cysts noted were manifested with thickened and enhancing cyst walls; fine needle aspirate cytological examinations for the complicated cysts revealed no malignancy. Fibrocystic changes with fibro adenomas were noted in two patients.

Other benign findings included fibroadenosis in six patients (0.06%) (Fig. 3), hormonally active tissue in one patient (0.01%) (Fig. 4), dilated ducts in two patients (0.02%) and intra mammary lymph nodes in six patients (Fig. 2). Benign tumors were noted in 14 patients (16.2%), findings included fibroadenomas in 12 patients (13.9%); fibroadenomas were noted as multiple lesions in eight patients and as a solitary lesion in two patients. Combined fibrocystic changes and fibroadenomas were seen in two patients (Figs. 5 and 6). Other benign tumors included phyllodes tumor in one patient and intra ductal papilloma in one patient (Fig. 7). No malignancy was noted in this group on follow up for 20 months.

5.2. Malignant changes (n = 24)

MRM demonstrated asymmetric density secondary to malignant lesions in 24 patients (27.9%) of these there were 30 focal malignant lesions in 23 patients and recurrent scar tumor in
Asymmetrical dense breast secondary to fibrocystic diseases was better evaluated with MRM as cystic contents and wall thickness and their pattern of enhancement allowed confident exclusion of malignancy.

(A) MRM Axial 3D FSPGR revealed asymmetric breast density with multiple small enhancing nodules at the left breast ... proved to be fibroadenosis. Intra mammary lymph node at outer quadrant left breast characterized by internal fat contents into incidental intra mammary lymph node was noted at the outer quadrant of the left breast. (B and C) MRM: axial 3D FSPGR, sagittal STIR of the left breast architectural distortion of the left breast, multiple small oval shaped masses bright on T2 weighted images ... biopsy revealed fibroadenosis.

Hormonally reactive tissue, MRM showed localized region of enhancement. Dynamic study revealed benign type of enhancement with delayed plateau ... Biopsy confirmed benign changes.
Fig. 5  (A and B) Multiple fibro adenomas seen as well circumscribed lesions showing hyper intense signals on T2 fat suppression images. Lesion 1 showed slow enhancement with delayed plateau (typical for fibroadenoma). Lesion 2 showed early strong enhancement with delayed plateau.
Fig. 6  Asymmetric breast density due to small oval shaped well defined fibroadenoma at the left breast exhibits hyper intense signals on sagittal STIR image with slow progressive enhancement on dynamic study.

Fig. 7  Breast MRI axial T2 weight image and sagittal FSPGR left breast showed a large well – circumscribed mass of smooth margin with central cystic components. On US the lesions showed well defined outline, low echogenicity and central cystic components. Biopsy of the lesion confirmed benign phyllode tumor. The lesion showed type II temporal enhancement curve (early strong enhancement within first 2 min and subsequent plateau.)
one patient, malignant lesions were diagnosed on MRI based on combined morphological features (as irregular shape, masses with speculated borders) and dynamic enhancement curves of the lesions. Histopathological findings confirmed malignancy in all the suspicious lesions, there were no false positive MRI malignant lesions (Fig. 8).

6. Discussion

Our study was designed to evaluate the utility of breast MRI for the detection of occult solid and cystic lesions in patient with asymmetric dense breasts and also for characterization of lesions detected on mammograms.

In the literatures asymmetric breast tissues were reported to be almost benign while focal asymmetric densities may represent masses with borders that are either ill-defined or obscured by surrounding fibroglandular tissue rather than asymmetric tissue (7–9).

In agreement with the literatures, the majority of the patients, included in this study with asymmetric density identified on mammograms (72%), had benign mammary changes, while 27.9% had malignant breast lesions.

In this study breast MRI confirmed asymmetric densities to be secondary to asymmetric breast tissue size in 23.2% of our patients and no underlying masses or cysts were detected. Fibrocystic changes represented the most common cause of mammographic asymmetric breast densities, on MRI the lesions appeared as well defined cystic lesions of variable sizes that showed smooth wall with no enhancement; complicated cysts showing wall enhancement and or thickening was indicative for fine needle aspirations and cytological examinations. Breast mammography showed relatively low sensitivity in such patient with dense breasts. Fibrocystic changes can be well evaluated by ultrasonography, however, associated benign breast changes or hidden malignant lesions could be missed on ultrasonography (9–11). So still, MRI has a role in the diagnosis of fibrocystic disease to exclude unexpected associated malignant lesions.

Fibroadenosis was also a common benign cause of asymmetric breast densities, which was encountered in this study in 0.6% of our cases. On U/S the fibro adenosis appeared as multiple focal hypoechoic lesions of discrete outlines, which represent areas of lobular hyperplasia (adenosis) interspersed with bands of connective tissue fibrosis (sclerosis). On MRI it appeared as small oval or lobulated masses of sizes around 10 mm or less, the lesions showed delayed plateau type of enhancement.

Fibro adenoma appeared as well defined masses that showed delayed plateau of enhancement, some lesions showed non enhancing internal septation (7,10,11).

Intraductal papilloma appeared as smooth rounded enhancing mass of morphologically benign feature showing rapid enhancement and wash out with non specific MRI findings, final diagnosis was made after biopsy.

Multiple distended fluid filled ducts showed no enhancement noted mainly at the retro areola appeared hyper intense on T2 weighted sequences.

Intra mammary lymph nodes appear as rounded or longitudinal shaped masses containing fat which is the clue for MRI diagnosis (7,12).

In this study asymmetric breast density was secondary to malignant lesions in 27.9%. Breast MR allowed better characterizations of the lesions by their morphological features, irregular outlines, speculation and by enhancement pattern where malignant lesion showed intense early enhancement with the first 2 min after contrast administration with subsequent wash out. Also MRI allowed evaluation of involved important lymph node groups at axillary and along the internal mammary arteries regions.

Findings in recent studies (7,11) with state-of-the-art technology show the ability of breast MRI to depict an occult malignancy in women with dense breast tissue.

Our results indicate that breast MRI can be an effective adjunct imaging examination in the evaluation of women with asymmetric dense breast tissue at mammography.

7. In conclusion

An important advantage of MR imaging compared with conventional techniques (Mammography and US) is that it allows more confident management in patients with asymmetric dense breast parenchyma, especially in cases with negative findings.

Benign–appearing findings on mammography can be better evaluated with MRI, so enhancing foci or masses in these patients are better characterized and cannot be easily missed (13,14).
Also breast MR allows better characterization of highly probable malignant lesions. Combined morphological feature and dynamic enhancement pattern of the lesions allowed increased sensitivity, and accuracy for lesion characterizations.

References