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ORIGINAL ARTICLE

Role of dynamic contrast enhanced MRI in evaluation of post-operative breast lesions

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KEYWORDS

DCE-MRI;
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Abstract *Purpose:* To evaluate the role of dynamic contrast enhanced magnetic resonance imaging in differentiation between benign postoperative changes and recurrent malignant tumor.
Patients & methods: This study was performed during the time from August 2014 till August 2015. Enrolled in this study were 50 female patients and all of them were breast cancer patients that had been candidates for breast conserving surgery, modified radical mastectomy and reconstructive surgery using autologous tissue reconstruction; DCE-MRI was done for all patients.
Results: In this study, 12 patients (24%) were with recurrent malignant tumor, 7 patients (14%) with postoperative fat necrosis, 10 patients (20%) with postoperative seroma, 10 patients (20%) with diffuse skin thickening and edema, and 6 patients (12%) with postoperative scar tissue; the remaining 5 patients (10%) were normal. Dynamic contrast enhanced MRI has sensitivity of 85.7%, specificity of 100%, PPV of 100%, NPV of 93.3% and accuracy of 95.6% in differentiation between benign postoperative changes and recurrent malignant tumors.

1. Introduction

Preventing local recurrence in women who undergo breast conserving therapy or mastectomy is important because local recurrence is associated with increased cost, psychological distress, and potentially worse prognosis of the disease (1).

Presence of cancer cells in the vicinity of the primary tumor after resection in period between 3 and 12 months is more likely a residual tumor. Most doctors consider cancer to be recurrence if there were no signs of cancer for at least 2 years (2).

Architectural distortion and increased density at the lumpectomy site as well as post-treatment edema may impair accurate detection of recurrence at mammography and ultrasonography (US) (3).

Dynamic contrast-enhanced magnetic resonance imaging (DCE-MR) has been shown to aid significantly in detection and characterization of primary and recurrent breast cancers (4). The most important factor is that MRI can assess both lesion morphology and enhancement kinetics (5).

The sensitivity of breast MR imaging for detection of residual and recurrent tumor in the post-breast conservative therapy (BCT) is over 90% (6). Breast MR imaging has been

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shown to be useful in differentiating scar tissue from tumor recurrence; in particular, non-enhancing areas have a high negative predictive value for malignancy (88–96%) (7,8).

The aim of the study was to evaluate the role of dynamic contrast enhanced magnetic resonance imaging in differentiation between benign postoperative changes and recurrent malignant tumors.

2. Patients & methods

This study was performed during the time from August 2013 till August 2015. Enrolled in this study were 50 female patients who underwent prior surgery for malignant breast lesions and are suspected to have local regional recurrence. 25 patients underwent breast conserving surgery (lumpectomy versus quadrantectomy), 12 patients underwent modified radical mastectomy and 13 patients underwent reconstructive surgery using autologous tissue reconstruction.

Their age range was 30–70 years with a mean age of 50.98 years. The indication for referral to our MRI unit in Mansoura university hospital was diffuse breast enlargement in 15 patients, palpable lump in 24 patients, and routine post-operative follow-up (6 months up to 2 years post-surgery) in 11 patients.

Exclusion criteria were as follows:

Patients who have contraindications to do MRI as patients with cardiac pacemaker, and patients with cochlear implant and ocular foreign body.

3. Methods

All patients underwent full history taking, general and local examination.

3.1. Mammography and complementary ultrasound examination

Mammography was performed for 38 patients, including both Cranio caudal (CC) and medio lateral (ML) views. Cases with modified radical mastectomy could not handle breast compression elicited during mammography examination.

High resolution conventional ultrasound was performed for 50 patients by 8–12 MHz linear array transducer.

3.2. MR imaging

In 50 patients, MRI of the breast was performed on superconducting 1.5 T MR imaging unit (Philips Ingenia). All patients were examined in the prone position using dedicated breast coil.

4. MRI protocol

The following protocol was applied for all patients.

A. Localizing sagittal protocol (scout view)
B. T1-weighted pulse sequence

Axial non-fat saturated TIWI was obtained by FSE with the following imaging parameters: TR 450 ms, TE 14 ms, slice thickness 3 mm, field of view (FOV) 300–360 mm and matrix was 307 × 512.

C. T2-weighted pulse sequence

Axial non-fat-suppressed T2-weighted turbo spin-echo was obtained with the following parameters TR 4500, TE 97, matrix 384 × 512 and slice thickness 3 mm.

D. Short TI inversion recovery (STIR)

Axial STIR was obtained with the following parameters: TR 7000–9000 ms, TE 70 ms and inversion time (TI) was 150 ms, slice thickness was 3–4 mm with inter-slice gap 1 mm, field of view (FOV) 300–360 mm and the matrix was 307 × 512.

E. Dynamic study

All dynamic studies were made in the axial plane with fat suppression by applying fat saturated pulse. The sequence used was FLASH 3-D GRE-T1WI with the following parameters: TR 4–8 ms, TE 2 ms, flip angle 20–25°, slice thickness 2 mm with no inter-slice gap, FOV 300–360 mm and the matrix was 307 × 512. Dynamic contrast enhanced MRI was performed after injection of a bolus of gadopentetate dimeglumine, in a dose of 0.2 m-mol/kg using an automated injector at a rate of 3–5 ml/s through a 18–20 gauge intravenous cannula inserted in an ante-cubital vein. This was followed by a bolus injection of saline (total of 20 ml at 3–5 ml/s).

Dynamic study consists of one pre-contrast and 5 post-contrast series, each of them took about 1.16 min with a break between the pre-contrast and post-contrast study about 20 s.

5. Image post-processing

Image post-processing includes image subtraction which was obtained by subtracting each of the pre-contrast images from each post-contrast series images, creation of time to signal intensity curve for suspicious enhancing lesions and maximum intensity projection (MIP) views obtained through each orthogonal plane, producing sagittal, coronal and axial projection.

5.1. Image analysis

STIR images were first examined to detect edema, postoperative seroma and hematoma. T1WI was also examined to detect fat within the lesion.

6. Morphological analysis

Lesions were classified as a mass, an area of non-mass-like enhancement or a focus.

6.1. Mass

A mass is a three-dimensional, space-occupying lesion. It is usually visible on pre-contrast T1 or T2 weighted images.