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ORIGINAL ARTICLE

# Sonoelastography versus dynamic magnetic resonance imaging in evaluating BI-RADS III and IV breast masses

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**KEYWORDS**

Sonoelastography;
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**Abstract** *Background:* Several clinical studies showed that sonoelastography was useful for differentiation of benign and malignant breast lesions. Contrast-enhanced MRI has emerged as a promising tool in the detection, diagnosis, and staging of breast cancer.
*Aim of work:* To study the role of sonoelastography versus dynamic MRI in evaluating BI-RADS III, IV breast masses and detect which modality is of better sensitivity and specificity trying to guide the patient either to follow-up the lesion or proceed to lesion excision.
*Subjects and methods:* The study included 50 Egyptian patients (ages ranged from 32 to 58 years) who presented by breast masses categorized as BI-RADS III, IV by mammography and ultrasound. Sonoelastography and dynamic MRI were done for all the patients.
*Results:* Differentiation between BI-RADS III and IV by US elastography had 84% sensitivity and 84% specificity and MRI had 88% sensitivity and 80% specificity.
*Conclusion:* Regarding the sonoelastography, it is an easy cheap modality. The elasticity score is an important parameter for lesion characterization. Combination of morphologic and dynamic MRI

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studies is very important for breast lesion evaluation. MRI is more sensitive but less specific than sonoelastography. Finally if we find any suspicious character elicited by either sonoelastography or MRI (BI-RADS IV), lesion excision is recommended.



## 1. Introduction

Breast masses have a variety of etiologies, benign and malignant. Fibroadenoma is the most common benign breast mass; invasive ductal carcinoma is the most common malignancy (1). However most breast masses are benign, breast cancer is the most common cancer and the second leading cause of cancer deaths in women [2].

Ultrasonography can effectively distinguish solid masses from cysts, which account for approximately 25% of breast lesions also it differentiate benign from malignant lesions if their criteria of diagnosis are fulfilled [3].

Magnetic resonance imaging (MRI) is being studied to determine its usefulness in breast masses. Gadolinium contrast is used to enhance the vascularity of malignant lesions. Although MRI is highly sensitive (85–100%), it lacks specificity (47–67%) [4].

It is becoming increasingly clear that while most investigators have used either enhancement kinetics or lesion morphology in an attempt to differentiate benign from malignant lesions identified on contrast-enhanced MR imaging studies, the integration of both kinetic and morphologic information may ultimately be needed to achieve optimal discrimination [5].

Kuhl et al. [5] described such an integration of kinetics and architecture as it is used in their practice. The authors make the very important point that there must be concordance between the kinetic information and the morphologic features.

There may be malignant lesions, such as certain invasive ductal and lobular carcinomas and certain ductal carcinoma in situ lesions that will not enhance rapidly but in which lesion morphology (i.e., architectural distortion, mass with speculated borders, or ductal enhancement) suggests the presence of malignancy [5,6].

Sonoelastography is an imaging modality that can quantitatively measure tissue elasticity with the use of sonography [7].

Several clinical studies showed that sonoelastography was useful for differentiation benign and malignant breast lesions, with sensitivity of 78.0–100% and specificity of 91.0–98.5%. A discrepancy in lesion sizes between the use of B-mode sonography and sonoelastography was a key factor for the diagnostic criteria in several studies [8–10].

Real-time tissue elastography may provide additional characterization of breast lesions, improving specificity, particularly for low-suspicion lesions [11].

## 2. Methodology

### 2.1. Patients

All the patients were subjected for conventional digital mammographic examination.

Real-time freehand US elastography was performed in 50 consecutive women who underwent evaluation for breast lesions at the National Cancer Institute, Cairo University between February 2009 and June 2010. The lesions were detected at conventional B-mode US and were classified as category III, IV lesions according to the Breast Imaging Recording and Data System (BI-RADS) criteria for US [12]. Lesions were defined as areas in the breast tissue that were hypoechoic or isoechoic (compared with the subcutaneous fat) on B-mode images and included both mass-forming lesions and non-mass-forming lesions. At B-mode imaging, lesions that were clearly cystic or those that appeared as fat islands were not included.

MR mammographic study was done for the patients and evaluated by two radiologists in consensus and blinded to histological diagnosis.

The lesions were morphologically assessed as regards its intensity and definition and presence or absence of lymph nodes. The lesions were also dynamically assessed and time intensity curves were done to assess the pattern of contrast uptake and washout.

### 2.2. Equipments

Conventional US was performed by using an annular-array mechanical sector scanner with a frequency of 7.5 MHz (Hitachi Medical Systems). All elasticity images were obtained with a system that consisted of a digital US scanner (EUB-6500; Hitachi Medical, Tokyo, Japan). The US probe was a 7.5-MHz liner electronic probe (EUP-L53; Hitachi Medical). None of the patients in this study experienced adverse events from either conventional US or elastography.

MRI examinations were obtained on a superconducting 1.5 T, MR unit (Signa Horizon, GE Medical Systems, Milwaukee, Wisconsin, USA). The following sequences were obtained and reviewed: T1, T2, fat saturation and dynamic post contrast study using gadopentetate dimeglumine (Magnevist; Nihon Schering, Osaka, Japan) or gadodiamide hydrate (Omniscan; Daiichi Pharmaceutical Co., Tokyo, Japan). Multiple dynamic and a subtraction sequences were taken then a time intensity curves were done.

The parameters for TIWIs were a repetition time of 400–620 ms, echo time of 20–40 ms (400–620/20–40), while the parameters for T2WIs were 2000–4000/80–120. Slice thickness of 4–5 mm, interval of 0.8–1 mm and matrix of $256 \times 192$ were used. The field of view was 160–320 mm.

### 2.3. Imaging methods

#### 2.3.1. Conventional US

First, conventional US images of the breast were obtained. During our conventional examination, we obtained B-mode images. Lesion size was defined as the diameter of the hypoechoic lesion at B-mode US.

Lesions were assigned as BI-RADS III or IV

The BI-RADS category of each lesion was determined by the radiologists with knowledge of the results of physical