Imaging Evaluation of Malignant Breast Lesions by Digital Mammography, USG and DCE-MRI

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Abstract

Introduction: Breast cancer is in a rising trend in India with breast cancer accounting for 40-60% of cancers in women, next to which is the cervical cancer.

Aim: The aim of this article was to evaluate the characteristic features of malignant breast lesions and to compare the sensitivity, specificity and accuracy of digital mammography, sonography and MRI with histopathology correlation. Classification of all breast lesions according to the breast imaging reporting and data system final assessment categories (BI-RADS) was done.

Materials and Methods: This was a prospective diagnostic study conducted on 52 female patients from 1st June 2021 to 31st May 2022 in the Department of Radiodiagnosis, Silchar Medical College and Hospital, Silchar.

Results: Out of 52 patients, 19 cases were found to be malignant of which 18 cases were intraductal carcinoma and 1 case of malignant phylloides. Most commonly encountered characterstics were spiculated margin, irregular shape and pleomorphic calcifications in mammography, posterior acoustic shadowing and internal vascularity in USG, and inhomogenous enhancement pattern with type II or III kinetic curve in DCE-MRI. The sensitivity, specificity and accuracy of MRI was found to be highest as 94.74%, 96.97%, 96.15% respectively.

Conclusion: Thus the study concluded that MRI appears to be more sensitive than mammography or USG in detecting malignantlesions in women with palpable breast lumps. Classification of the lesions according to BI-RADS helps to improve the management of lesions.

Keywords: Mammography, Ultrasonography, Magnetic Resonance Imaging.

Introduction

There is a significant rise in the incidence of breast cancer in India and worldwide. According to data, breast cancer is the most common cancer in women in India, with cervix cancer being second. They account for 40% to 50% of all cancer cases in India. In cases of breast cancer, 5% of cases occur before the age of 35, and 10% occur before the age of 43. By the age of 55 years, 50% of all cases are expected to occur. As a result,

the median age of breast cancer cases is 55 years.[1]

Since breast cancer is an important cause of mortality, identifying the disease in its early stage is crucial for the management of the disease. Mammography (MG) is the best technique for screening and identifying patients with non-mass-like breast lesions and microcalcifications. Considering the false positive and false-negative results, ultrasound (USG) is not a perfect screening modality [2]. Magnetic resonance imaging (MRI) can be a valuable supplement to MG and US as newer MRI techniques are developing, the multiparametric MRI reaches a specificity up to 100% [3].

The Breast Imaging Reporting and Data System (BI-RADS) is a standardised system for reporting breast pathology noticed during mammography, ultrasound, and magnetic resonance imaging (MRI). By providing a lexicon of descriptors, a reporting structure that links assessment categories to management recommendations, and a framework for data collection and auditing, this structured system encourages consistency between reports and facilitates clear communication between the radiologist and other physicians [4].

Materials and Method

A prospective study was conducted from 1st June 2021 to 31st May 2022, for a period of one year which involved 52 female patients presenting with palpable painful or painless breast lumps referred to the department of Radiodiagnosis ; Silchar Medical College and Hospital, Silchar. Patients underwent digital mammography, ultrasonography and MRI evaluation of both the breasts. For mammography two imaging projections of each breast, craniocaudal (CC) and mediolateral oblique (MLO) views were obtained using FUJI DIGITAL MAMMOGRAPHY SYSTEM, AMULET INNOVALITY. A dedicated breast ultrasound was performed with SAMSUNG RS80A with a high-frequency (3-12Hz) linear probe. The lesions were classified on gray scale ultrasound and color doppler imaging as BIRADS US categories. MRI evaluation was carried out using SIEMENS TIM AVANTO 1.5T SCANNER. Various conventional and advanced MR pulse sequences with contrast were used as per case requirements. Finally accuracy of the results were compared by taking pathological report as the gold standard.

Results

Of the 52 breast lesions examined, 33 (63.4%) were benign and 19 (36.5%) were malignant. Fibroadenomas were most common (17) amongst benign lesions followed by abscess (6) then fibrocystic disease (4). There were 1 case of benign phyllodes and 2 cases of fat necrosis. Pathologically malignant lesions included 18 cases of infiltrating ductal carcinoma and 1 case of malignant phyllodes.

The age group included 15-60 years women referred to our department with the presenting complaint of breast lump. 45-55 years age group had the majority of cases, out of which only 1 case was benign and rest were malignant lesions.

Table 1: Describes the incidence of different benign and malignant lesions in our study.

FNAC/HPE	FREQUENCY	PERCENT
Benign phyllodes	1	1.90%
Fat necrosis	2	3.80%
Fibroadenoma	17	32.70%
Fibrocystic change	4	7.70%

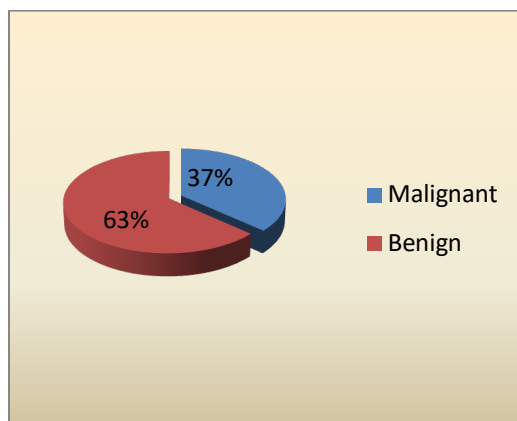|		
Galactocele	3	5.80%
IDC	18	34.60%
Malignant phyllodes	1	1.90%
Abscess	6	11.50%
Total	52	100.00%

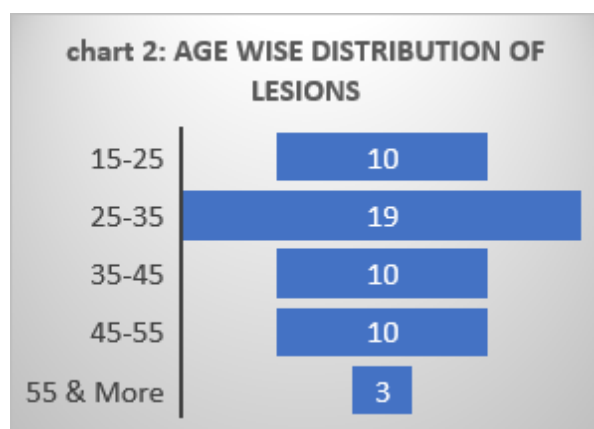**Chart 1: Distribution of malignant and benign lesions.**

Chart 2: Age wise distribution of lesions

Malignant lesions were more common in the age group of 45-55 years (47.4%). No malignant lesions were detected in the age group of 15-35 years.

On mammography features most frequently seen associated with malignancy were irregular shape(63.2%), spiculated margin 12(63.2%)and microcalcifications (most commonly pleomorphic type, 21.1%) with skin or pectoralis major muscle invasion (fig 1)
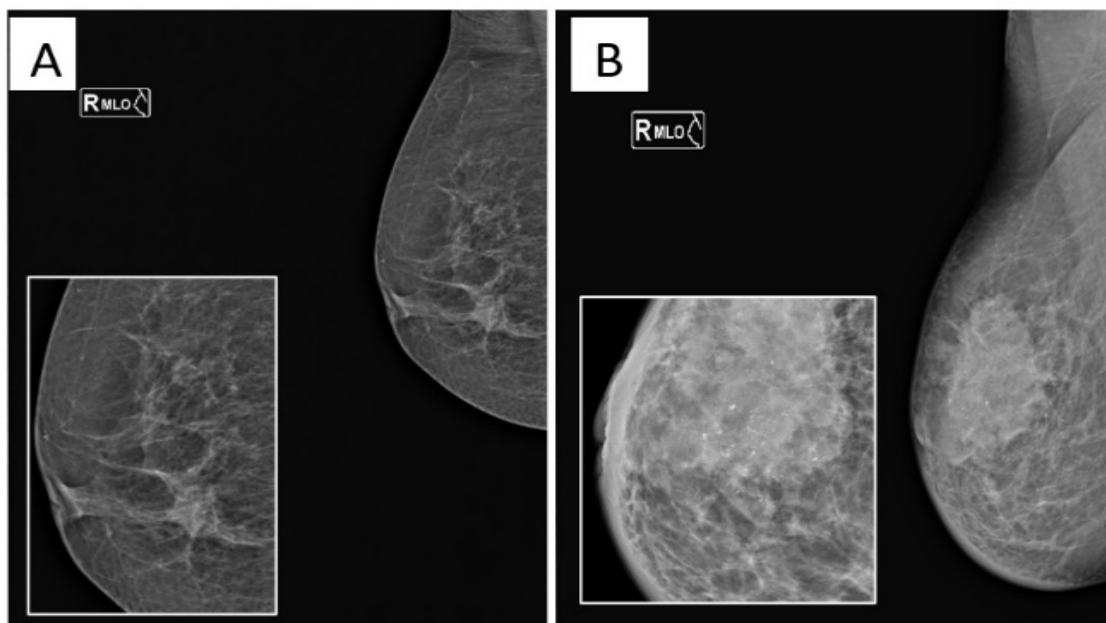
Figure 1: In two different patients coming for the evaluation of breast lumps HPE found intraductal carcinoma in both of the cases. In patient (A) The lesion is hyperdense, irregular and showing spiculated margin, in patient (B) the lesion has lobulated margin and irregular shape. Skin thickening and pleomorphic type of calcifications noted in the mass.

On USG, features most frequently seen associated with malignancy were hypoechogenicity (89.5%), irregular shape(63.2%), non-circumscribed margin(100%), posterior acoustic shadowing (94.7%)(fig 2)and internal vascularity (100%) on colour doppler study.
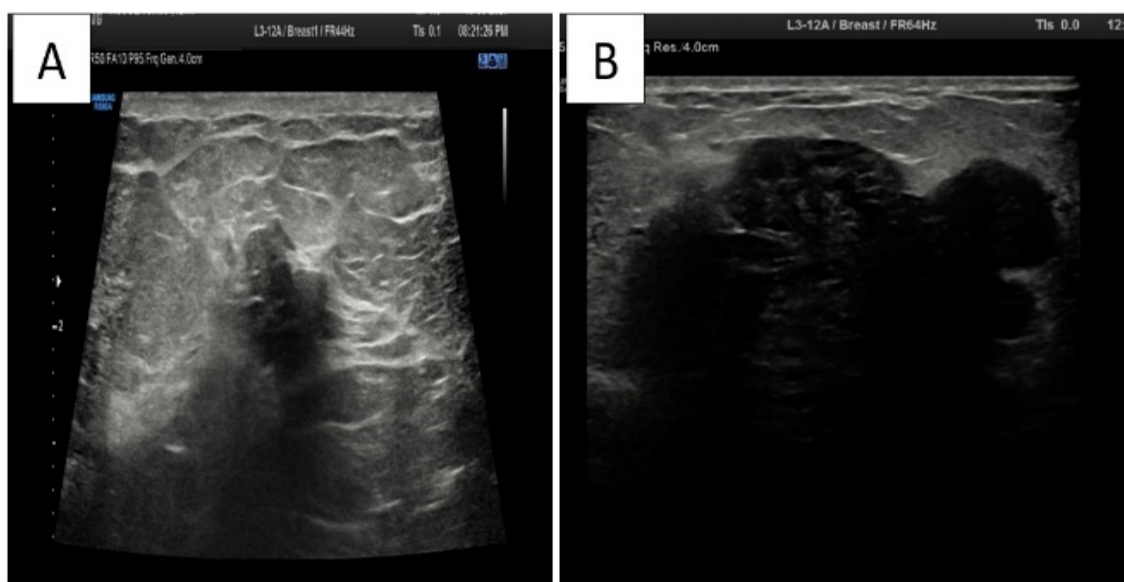

Figure 2: When the patients were followed up with breast USG, a hypoechoic lobulated lesion showing posterior acoustic shadowing is noted in both patients A and B

On DCE-MRI features most frequently seen associated with malignancy was heterogenous enhancement with 94.7% of them showing type III kinetic curve (fig 3).
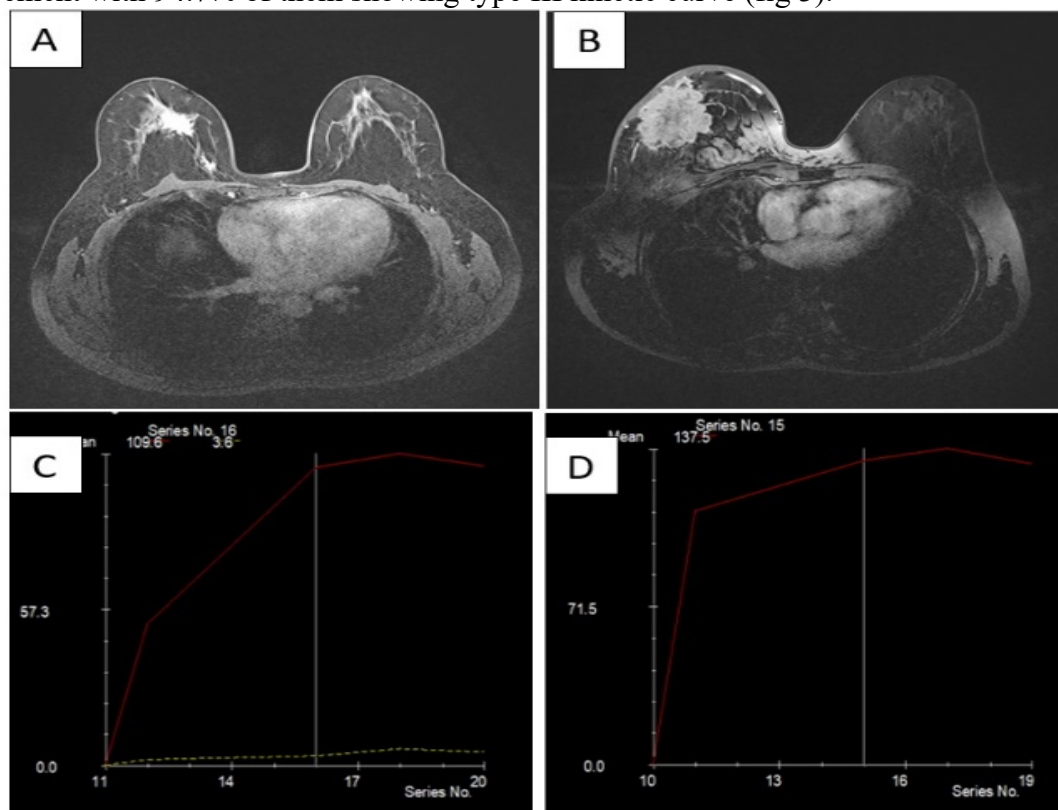

Figure 3: Subsequent DCE-MRI of the 1st patient shows homogenous pattern of enhancement (A) and washout out kinetics (type III curve) was found on kinetic curve analysis (B). In the 2nd patient heterogeneous pattern of enhancement (C) and type III curve (D) was found.

A diagnosis of category BI-RADS 4 and 5 was assigned by mammography in 15 cases, by ultrasound in 17 cases, by breast MRI in 18 cases and ultrasound and MRI combined in 18 cases. False-negative diagnoses (BI-RADS 2 or 3) were made by mammography in 4 patients, by ultrasound in 2 patients, and by MRI in 1 patient. If mammography and ultrasound were read in combination, the number of false-negative diagnoses decreased to 1.

By comparing all the three modalities; the sensitivity, specificity and accuracy of MRI is found to be the highest in detecting malignant vs benign lesions. However if combined mammography and ultrasonography assessment done then the sensitivity was found same as that of MRI.

Table 2: Comparison of Different Modalities By Statistical Analysis-

	MG	USG	USG & MG	MRI
Sensitivity	78.95%	89.47%	94.74%	94.74%
Specificity	84.85%	93.94%	78.79%	96.97%%
Accuracy	82.69%	92.31%	84.62%	96.15%

Chart 3: Comparison of sensitivity, specificity and accuracy of MG,USG and MRI

Discussion

In our study all the cases of carcinoma occurred above 35 years of age. This correlated with the study of Kailash Singh *et al* (2008) [5], where all cases of carcinoma were above 35 years of age. In our present study, peak incidence of carcinoma was 45-55 years age group (47.4.8%), followed by the 35-45 years age group (36.8%). Our study is comparable to the study of Jitendra Singh Nigam *et al* (2014) [6], where peak incidence of carcinoma of breast was found in the 4th and 5th decade.

In our study, we found that mammographic features most helpful to denote malignancy are irregular shape, spiculated margin and pleomorphic calcifications. According to Liberman *et al* (1998) [7], the features with highest positive predictive value of carcinoma were spiculated margins (8l%), irregular shape (73%), linear calcification morphology (81%), and segmental or linear calcification distribution (74% and 68% respectively).

In a study by Gurung *et al* (2010) [8], majority of malignant lesions showed lobulated shape (37.1%) and spiculated margin (60%). According to Kailash Singh *et al* (2008) [5], USG the features that most

reliably predicted and characterized masses as malignant were irregular shape (53% were malignant), Non-circumscribed margins (41% were malignant) and width:AP ratio = 1.4 (39% were malignant). In our study, ultrasonographic features that most reliably characterized lesions as malignant were, non-circumscribed margins (100%), irregular shape (63.2%), posterior acoustic shadowing (94.7%) and hypoechogenicity (89.5%). No hyperechoic mass was malignant in our study.

Our study correlated with the study conducted by Chandak *et al* (2017) [9], where 78.26% of the malignant lesions were markedly hypoechoic. According to the study conducted by Rahbar *et al* (1999) [10], features that characterize masses as malignant included irregular shape (61% were malignant), microlobulated (67% were malignant) or spiculated (67% were malignant) margins, and width-to–AP dimension ratio of 1.4 or less (40% were malignant). In our study, DCE-MRI showed heterogenous pattern of enhancement in 17/19 (89.4%) malignant lesions. According to a study by Gulnaz Shafqat *et al* (2011) [11], 30/38 (78.9%) lesions showed heterogenous pattern of enhancement. In a

study Youssef *et al* (2017) [12], six lesions showed heterogeneous enhancement all of them were malignant.

In a study by Kumari *et al* (2020) [13], 96% malignant lesions showed Type III kinetic curve. In case of our study 18/19 (94.7%) malignant lesions showing type III kinetic curve. According to a study by Gulnaz Shafqat *et al* (2011) [11], out of 38 malignant lesions, 35(92.1%) were exhibiting type II and III curve. In a study by Balasubramanian *et al* (2016)[14], 16/17 (94.11%) malignant lesions showing type II and III kinetic curve. These studies correlated well with our observation.

However in the study by Kuhl C K (1994)[15],the distribution of curvetypes for breast cancers was type I, 8.9%; type II, 33.6%; and type III, 57.4%.

Conclusion

Breast cancer is the main cause of mortality and morbidity among women in India. It becomes crucial to look for breast lesions early in order to identify a favourable prognosis. The most extensively used and established method of detecting breast lesions is combined use of ultrasound and mammography.

MR mammography has a major role in the evaluation of suspicious breast lesion in dense breast. When dynamic enhancement characteristics are combined with the morphological characteristics of the lesion; the efficacy of the modality increases in differentiating benign and malignant lesions.

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