COMMON CLINICAL AND RADIOLOGICAL FINDING OF BREAST CANCER PATIENT PERFORMING BREAST MAGNETIC RESONANCE IMAGING AS DIAGNOSTIC TOOL

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ABSTRACT

Background

Breast cancer is the most commonly diagnosed cancer among women and the second cause of cancer mortality in women.

Objectives

This study aims to evaluate the role of magnetic resonance imaging (MRI) in the surgical management of patients with breast cancer.

Materials and Methods

This is an observational descriptive (retrospective and prospective) study, carried out in magnetic resonance imaging department of radiological center in Shahid Hemn teaching hospital and breast disease treatment center, Sulaymaniyah. One hundred sixty one patients screened with different breast complaint during (January of 2014- March of 2019). We focused on cases of breast cancer only were included 32 patients, also we analyzed the findings of the magnetic resonance imaging; Review was performed to determine lesion type (mass or non-mass), lesion descriptors, patient age, and biopsy. Histological findings were reviewed.

Results

Magnetic resonance imaging detected all cases of invasive ductal carcinoma (IDC) 13(40.6%), in which Sensitivity (100.0%), Specificity (54.5%), (PPV) Positive Predictive Value (27.1%), (NPV) Negative Predictive Value (100.0%), and accuracy (61.1%). While invasive lobular carcinoma (ILC) was 10 (31.25%), 9 cases were defined as malignant lesion.It is Sensitivity (90.0%), Specificity (58.8%), Positive Predictive Value (21.4%), Negative Predictive Value (97.9%), and Accuracy (62.2%). Magnetic resonance imaging sensitivity and specificity to differentiate between benign and malignant lesion were (84.8%) and (64.9%) but, Positive Predictive value, Negative Predictive Value and Accuracy were (58.3%), (88.1%), (72.2%) respectively. False positive were 20 (41.7%), while false negative were 5 (11.9%).

Conclusion

Magnetic resonance imaging is important in the management of breast cancer and accurate in assessing carcinoma extension and multiplicity. It is seen as being too sensitive, less specific.

Keywords: *Breast MRI, Breast cancer, Cancer staging.*

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INTRODUCTION

Contrast-enhanced magnetic resonance imaging (MRI) of the breast was first performed in the late 1980s in women with biopsy of proven carcinomas [1]. Its importance has increased in recent years. Breast MRI has emerged as a promising modality for the detection and diagnosis of breast cancer since the introduction of gadolinium-diethylenetriamine penta-acetic acid as a contrast agent [2]. It is important and vital for MRI to be used for the right indications because of economic reason and over-estimations.

In cases of occult breast carcinoma MRI is indicated to locate the site of primary malignancy in the breast due to its higher sensitivity, also MRI is able to identify occult malignancy in the contralateral breast, monitoring neoadjuvant chemotherapy, preoperative tumor staging [3].

MRI significantly increased detection of early breast cancer beyond that seen with mammography or mammography combined with ultrasound [4]. MRI is virtually uninfluenced by breast density, but the specificity is variable and the cost is high [5]. In case of lumpectomy and those with close or positive surgical margins, and the extent of residual disease, MRI may help determine whether repeat excision or mastectomy is appropriate, also MRI is able to detect bulky residual disease at the lumpectomy site and differentiated from recurrence [3].

Preoperative MRI of the breasts has been proven to be the most sensitive imaging modality in the detection of multifocal or multicentric tumor manifestations as well as simultaneous contralateral breast cancer [6]. MRI efficacy as a screening tool is limited by its increased cost relative to mammography, as well as increased reader and scanner times. So time expenditure in image acquisition and radiologist interpretation remain significant barriers to its implementation as a screening modality [7].

For redducing the false-positive diagnosis rate in MRI, it needs differentiation between true enhancement and pseudo enhancement due to artifacts, recognizing normal enhancing structures and analyzing enhancement according to the BI-RADS Classification [8].

PATIENTS AND METHODS

This is an observational descriptive (retrospective and prospective) study, carried out in MRI department of radiological center in Shahid Hemn teaching hospital and breast disease treatment center, Sulaymaniyah. One hundred sixty one patients examined with different breast complaints, only 32 cases were diagnosed as breast cancer underwent dynamic MRI during (January of 2014-March of 2019).

After approval was obtained from the Ethics Committee of the Sulaimani Medical College for this study, the inclusion criteria of this study was non-pregnant, non-lactating, dense breast with positive family history, patient diagnosed with breast cancer underwent diagnostic gadolinium-enhanced breast MRI. Exclusion criteria include; over weight or obese women, metallic implant like pacemaker, ocular implant, lack of IV (intravenous) access, patient with allergy to contrast or unable to lie prone, renal insufficiency, metallic breast implant.

We interviewed the patient and an oral informed consent was taken, while there are groups of patient we phoned back or took information about them from saved file and data that they had in the breast center. A structured proforma questionnaire was designed; the data on socio-demographic characteristics of patients such as age, residency, chief complaint, menstrual history, obstetric history, history of previous breast disease or surgery, family history of breast diseases and screened for contraindications to MRI.

Our patients scheduled between the 5th and 14th day of the cycle (because same time hormonally induced enhancement may mimic disease). Every patient should have renal function tests, also measure their body weight. Patient asked to wear a gown during the exam, a nurse putted an IV line for the administration of the contrast material (gadolinium). Contrast is administered in dose 0.1 mmol/kg.

We did clinical examination (for new cases while old cases we get the note from their files) started with inspection and palpation. For palpation we will examine all breast tissue as well as the axillary lymph nodes. By clinical examination breast lumpiness or nodularity, which varies considerably among women,

we are also classifying patients' breast nodularity like that determined according to (Goodson) classified as less nodular and more nodular breast [9].

The patient placed prone into the breast coil and supported so that the breasts hang in a dependent position, which helps minimize respiratory motion and lets gravity separate the breasts. The imaging session lasts between (15-20) minute. Typically breast MRI is performed on a 1.5 Tesla magnet commercially available system was Philips machine, MRI interpretation done by expert radiologist; had about 10 year history of experience. Scanning slice thickness is about 3 mm.

The sequences routinely obtained are, initial sequence evaluated is the pre- contrast axial T1 images are reviewed. After that axial T2 images are reviewed. Finally, MIP (maximum intensity projection) as it provides a 3D overview of both breasts and enhancing/ suspicious masses are easily detected. The MIP should be used as a basic overview and not relied on solely to interpret the images as it excludes non-enhancing lesions.

Regarding statistical analysis of the data, data have been tabulated and analyzed using Statistical Package for Social Science (IBM SPSS version 21). Categorical data were presented as number and percentages, whereas quantitative data were expressed as mean and SD and error. The Chi-square test and Pearson correlation coefficient(r) were used as tests for significance; the obtained results were judged statistically significant at $P \leq 0.05$ and highly significant at $P \leq 0.01$.

RESULTS

One hundred sixty one female patients were allocated to the study according to the inclusion criteria. In our study 33 cases were normal, while 38 cases had only benign finding, no need for biopsy they were programed to routine follow up. Only 90 patients underwent histopathological biopsy either true-cut biopsy or sectional biopsy. In our study 58 (64.5%) of patient had benign proved lesion, while 32 (35.5%) were proved malignant lesion, Figure 1.

In this study we took only malignant cases. In which the age was ranging from 31 to 76 years, with the mean ± SD (50.1 ± 12.3) years. Out of 32 patients 27 (84.4%) of them were married, while 5 (15.6%) of them were un-married. Most of the patients were from urban areas 21(65.6%), only 11(34.4%) of them from rural areas. Among the patients 1 (3.1%) were using oral contraceptive pill. Patients with previous breast diseases and previous breast operation were 2(6.2%). Patients with positive family history of breast cancer were 7(21.8%) first degree relative were 5(15.6%), while second degree were 2(6.2%). Mean age of menarche with SD was (13.1 ± 1.3) but for menopause was (47.8 ± 6.0). Regarding the parity of patients, multiparous were 6 (18.8%) while nulliparous were 26 (81.2%).

Patients' complaint was different, the most common symptom were mass 18 (56.2%), the second complaint mastalgia were 11 (34.3%), bloody nipple discharge and inverted nipple equal were 1(3.1%). axillary mass was 1 (3.1%). However 2 (6.4%) of patients were asymptomatic. Different clinical finding were noted, breast nodularity were different less nodular breast were 30 (93.75%), and more nodular breast were 2 (6.25%). Mass was the most common finding 22 (68.75%). Tenderness was 4 (12.5%), while nipple changes was 1 (3.1%), nipple discharge was 1 (3.1%). Skin changes were seen in 6 (18.75%) while axillary mass were 1 (3.1 %). Regarding breast density on mammogram according to ACR classification type A were 5(15.6%),type B 4(12.5%), type C 22(68.75%) and type D 1 (3.1%). All ladies had MRI, regarding lesion classification, mass lesions were 26 (81.25%), and Non-mass like lesions was 4 (12.5%). Regarding mass shape lobulated was 1 (3.8%), irregular were 25 (96.2%). While for margin smooth was 1 (3.1%), irregular were 20 (76.9%) and speculated were 5 (19.2%). Table 1 shows mass morphologic descriptors with sensitivity and positive predictive value, the sensitivity, specificity, PPV, NPV and accuracy of MRI for mass lesion were (87.1%), (25.9%), (40.3%), (77.8%) and (48.2%) respectively.

MRI in those patients who were reported as non-mass like lesion we had only segmental distributions were 4 (100%), MRI for non-mass like lesion results are as following; Sensitivity (100.0%), specificity (57.1%), PPV (40.0%), NPV (100.0%), and accuracy (66.7%). Regarding kinetic curves result like the following; steady or type 1 kinetic curve was 1 (3.1%) of patients, Plateau or type 2 curve were 3 (9.3%), wash out or type 3 curve which was noticed in 20 (62.5%) of patients, and inconclusive type

5 (15.6%), for type of kinetic curve P value was significant (< 0.001) in comparison of each type to tissue biopsy. Figure 2 shows percentages of kinetic curves with histologically proved lesion.

In our study 7 (21.8%) patients had DCIS, MRI detects 4cases as malignant lesion and 2 cases were normal, only 1 case was benign finding. MRI for DCIS had Sensitivity (57.1%), Specificity (47.0%), PPV (8.3%), NPV (92.9%) and Accuracy (47.8%). MRI detected all cases of IDC 13(40.6%), in which sensitivity (100.0%), specificity (54.5%), PPV (27.1%), NPV (100.0%), and accuracy (61.1%). While ILC were 10 (31.25%), only 1case was benign in MRI, other 9 cases were defined as malignant lesion. MRI in ILC had sensitivity (90.0%), specificity (58.8%), PPV (21.4%), NPV (97.9%), and sccuracy (62.2%). Table 2 Shows MRI finding with histopathology.

To see if there is correlation between age and MRI sensitivity and specificity we took the mean of age for both benign and malignant cases by MRI. The result was not significant P value (0.37), also by divided age in to ≥50 year and <50 year P value is not significant (0.17). Table 3 shows correlation between age and MRI finding

Regarding menopausal state we had 8 (25%) cases diagnosed with breast cancer were DCIS 2 (25%), IDC were 2(25%), ILC were 3 (37.5%), and others 1 (12.5%). Premenopausal cases were 24 cases (75%), DCIS were 5 (20.8%), IDC were 11 (45.8%), ILC were 7 (29.1%), others 1 (4.1%). Correlation between menopausal sate and histological subtype of breast cancer had no significant P value (0.67). MRI false positive were 20 (41.7%), while false negative were 5 (11.9%), sensitivity and specificity of MRI to differentiate between benign and malignant lesion were 84.8% and 64.9% but, PPV, NPV and accuracy were 58.3%, 88.1%, 72.2% respectively.

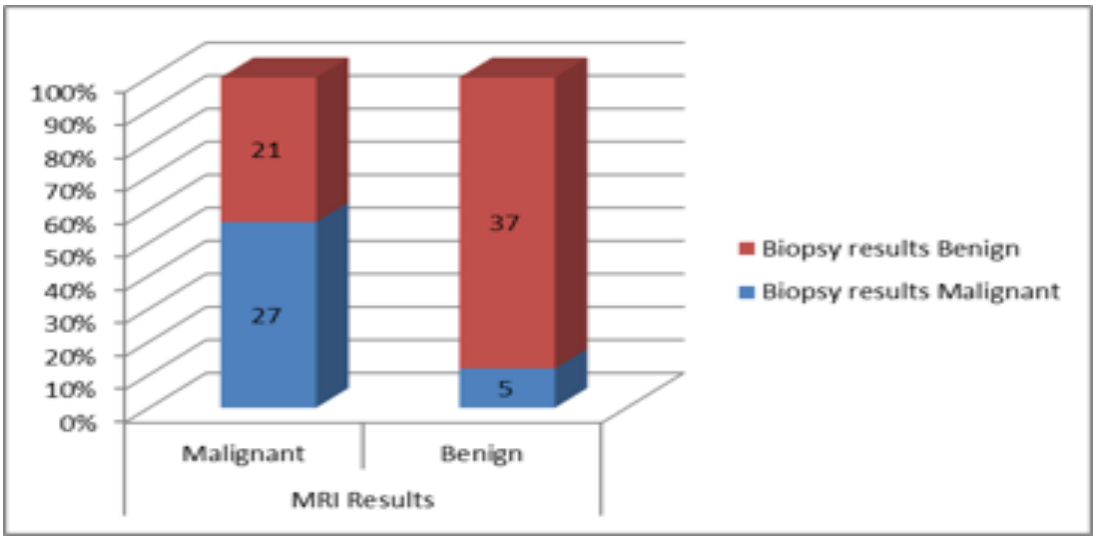

Figure 1. Percentage of Proved Benign and Malignant Lesions.

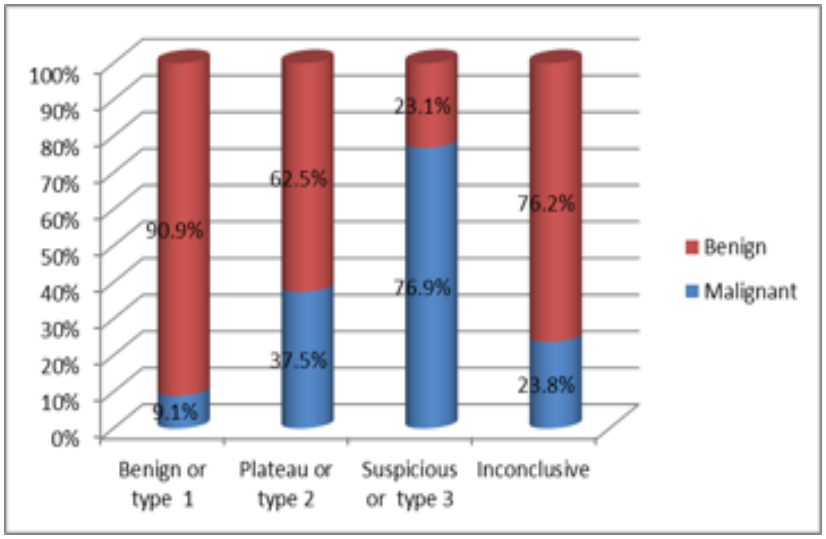

Figure 2. Percentages of Kinetic Curves with Histologically Proved Lesion.

Table 1. Mass Morphologic Descriptors with Sensitivity and Positive Predictive Value.

Descriptor	Frequency	Sensitivity Specificity	PPV &NPV
Shape :			
Lobulated	1(3.8)	15.0% 96.3%	85.7% 43.3%
Irregular	25(96.2)	92.6% 2.0%	65.8% 93.1%
Margin:			
Smooth	1(3.8)	62.5% 92.6%	92.6% 62.5%
Irregular	20(76.9)	74.1% 75.0%	66.7% 81.1%
Speculated	5(19.2)	18.5% 87.5%	50.0% 61.4%

Table 2. MRI Finding with Histopathology

Biopsy/ Type of cancer	MRI diagnosis Benign	Malignant
Biopsy findings:		
DCIS	3 (42.8%)	4(57.2%)
IDC	0 (0%)	13(100%)
ILC	1 (10%)	9(90%)
Metastatic adenocarcinoma (intra mammary LN)	0 (0%)	1(100%)
Intra ductal papillary carcinoma	0 (0%)	1(100%)

Table 3. Correlation between Age and MRI Finding.

Age/ MRI		MRI Malignant	Benign	P value
Age	≥ 50 years	13	44	0.17
	< 50 years	35	69	
Total		48	113	161

DISCUSSION

Contrast-enhanced MRI plays an important role in identification and management of breast disease with its recent technical advances [10]. MRI performed to complement mammography may increase the sensitivity and decrease the specificity compared with mammography alone [11]. In our study, we reported the age was ranging from 31 to 76 years, with the mean ± SD (50.1 ± 12.3) years. Most of the cases were married 27 (84.4%), while 5 (15.6%) of them were un-married. Mean age of menarche with SD was (13.1 ± 1.3) but for menopause was (47.8 ± 6.0). Multiparous were 6 (18.8%), while nulliparous were 26 (81.2%). Only 1 (3.1%) case was using oral contraceptive pill.

We focused on these factors because they are considering as a risk factor for breast cancer [12]. In this study 33 (20.5%) of them had normal MRI, but 5 cases were send for biopsy because of controversy of radiological finding. Low grad DCIS were 2 (40%) and 3 (60%) were benign. Kuhl in (University of Bonn, Germany) has done a study on MRI for diagnosis of pure ductal carcinoma in situ 7 (58%) of low grad. DCIS were negative on MRI. The result of that study agree with our finding that low grad DCIS could be normal in MRI, because the diagnosis is based on tissue contrast material enhancement in breast MRI which depends on a locally increased micro vessel density or capillary permeability. This is explanation for that 2 cases with DCIS and normal MRI, and 1case with DCIS but benign MRI in our finding [13].

Mass lesions were 26 (81.25). Non-mass like lesions were 4 (12.5%), with PPV (40.3%) for mass but PPV in non-mass (40.0 %.). In a study done by L. Liberman in (Memorial Sloan- Kettering Cancer Center, New York) showed that mass lesions carcinoma was found in 15 (25%) of them, while non-mass like lesion which was malignant lesion were 10 (25%) with PPV of 80%. Our study has similar finding regarding percentage and frequency of lesion as they had more mass lesion than non- mass and also most carcinoma cases were mass lesion. But it is PPV is higher than PPV of our study [14]. During comparison of histologic analysis of previous mentioned study and our study we see same difference in popularity and type of lesion, that study had carcinoma in 25 (25%), of which13 (52%) were DCIS and 12 (48%) were infiltrating carcinoma. IDC were 9 cases and ILC were 3. Twenty-two lesions (22%) showed high-risk lesions. LCIS were 10, atypical ductal hyperplasia in 10 and both LCIS and atypical ductal hyperplasia were 2.The remaining 53 lesions (53%) were benign [14].

While in our finding, histological analysis shows the commonest one was IDC 13(40.6%) followed by ILC were 10 (31.25%) cases. But DCIS were 7 (21.8%), metastatic adenocarcinoma (intra mammary LN) and intra ductal papillary carcinoma all of them had same result 1 (3.1%). In a study done by P. A. T. Baltzer and M. Benndorf (Institute of Diagnostic and Interventional Radiology, Friedrich-Schiller-University Jena, Germany) show15 malignant non-mass lesions, and 105 malignant mass lesions [15]. Those study and our study were agree in that the mass like lesion could be faced more than non-mass like lesion.

Also in our study mass shape were divided as following ; lobulated 1(3.8%) , irregular 25 (96.2%), while for margin of the mass were smooth 1 (3.8%), irregular 20 (76.9%), and speculated 3 (19.2%). This finding were disagree compared to other study by Peter R. Eby (University of Washington) in which lobulated 11 (20%),irregular 3 (6%), while for Mass margin were smooth 39 (78%), irregular 10 (20%), speculated 1 (2%). Regarding non-mass lesion our finding were segmental 4 (100 %), while previous study found non-mass like enhancement linear 12 (10%), segmental 10 (9%), ductal 1 (1%), and regional 20 (17%). It has other type finding that we did not have those types probably of sample size [16].

Regarding type of kinetic curves our results showed; steady or type 1 were 1 (3.1%), Plateau or type2 were 3 (9.3%) wash out or type 3 were 20 (62.5%), with significant P value < 0.001, this goes with the results of study done by Botond K. Szabo, (Huddinge University Hospital, Sweden) Steady curve or type 1 was only 2 (3%) were

malignant, plateau curve or type 2 had 13 (21%) malignant lesion and washout or type3 malignant lesion were 47 (76%) with P value <0.0001, by this we can conclude the different kinetic of enhancing mass lesions, and the time-to-peak enhancement are the most useful and independent predictors of malignancy using a standard dynamic sequence [17].

In our study sensitivity and specificity of MRI to differentiate between benign and malignant lesion were (84.8%) and (64.9%) but, PPV, NPV and Accuracy were (58.3%), (88.1%), (72.2%) respectively, our result was close to the results obtained by David A. Bluemke, study in which sensitivity of (88.1%), specificity of (67.7%), PPV (72.4%). [18] Study of Jeffrey C.Weinreb, MD, (New York University Medical Center), in which sensitivity for malignancies was (88%) and specificity was (84%), accuracy of (93%). This result was slightly higher than our result may be due to using both rates and patterns of enhancement to differentiate between benign and malignant lesions but we depend on histopathological report of detected lesions [10].

Regarding false positive were 20 (41.7%), while false negative were 5 (11.9%) with P value (< 0.001) other study P. A. T. Baltzer and M. Benndorf, had false positive were (31%), Non-mass lesions were the major cause of false-positive breast MRI findings [15].

In conclusions; it is an impractical tool for routine screening, but undoubtedly has a major role as an adjunct to mammography and ultrasonography. It is more accurate in assessing carcinoma extension and multiplicity. Also negative breast MRI findings should not be considered as absolute result of benignancy. Further studies are required, taking larger number of patients, over a longer period of time, including other breast diseases to evaluate the role of MRI in the management of breast diseases

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