Evaluate role of High-Resolution Ultrasonography in evaluation of breast masses and its correlation with Fine Needle Aspiration Cytology

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Abstract

Introduction: Breast carcinoma is the most common malignant tumor among women. It contributes to a significant proportion of all cancers in women worldwide (25%). Ultrasound is a helper tool used in union with mammography and clinical examination of breast in breast lesion screening. In patients with dense breast tissue, USG is a valuable aid in picking up and characterizing lesions. It has a highly capable in spotting lesions but is poor in specificity. To boost specificity, the ACR introduced the BIRADS to categorize breast masses.

Material and Methods: This is a prospective and observational study conducted in the Department of Radiodiagnosis, Al-Ameen medical college and Hospital from October 2021 to September 2022 presenting with complaints of palpable breast lesions and referred to the department of radiology. Structured proforma was used to collect the data. All the subjects who fulfilled the inclusion criteria were subjected to ultrasonography and FNAC. A high-resolution duplex Doppler sonography study using HITACHI ALOKA F-37 ultrasound machines with 5-13MHz linear transducer will be done. On ultrasound examination size, shape, margins, calcifications, Orientation, Echogenicity, posterior acoustic features, Lesion boundary, vascularity and axillary lymph nodes were accessed.

Results: In the study 20% had Family History of Breast Cancer. In the study on USG, margin was Circumscribed in 44%, 16% had indistinct, 28% had Micro lobulated and 12% had Spiculated. In the study on USG Echogenicity was Hypoechoic (66%), anechoic (24%), Complex cystic and solid (8%) and Isoechoic (2%). In the study on USG Posterior Echo Intensity was Post acoustic Enhancement in 18%, Shadowing in 30% and No, posterior features in 52%. In the study the study 96% had no infiltration and 4% had infiltration. In the study on Sono BIRADS, 46% were benign, 24% were Probably benign, 14% were Suspicious of malignancy and 16% were Highly suspicious of malignancy.

Conclusions: From the study it was concluded that High-Resolution Ultrasonography (BIRADS) had Sensitivity of 81.25%, specificity of 94.12%, PPV of 86.67%, NPV of 91.43%, Diagnostic Accuracy was 90%. Thus, USG is a reliable first line investigation in cases of breast lesions due to its good sensitivity and a primary diagnosis can be arrived at and the need for other investigations such as FNAC and Biopsy can be decided upon.

Characteristics of Breast lesions on USG also helps in differentiation of Benign and malignant lesions. Hence plays role in differentiation of benign and malignant lesions.

Keywords: Breast masses, Ultrasonography, Fine Needle Aspiration Cytology

INTRODUCTION

Breast carcinoma is the most common malignant tumor among women. It contributes to a significant proportion of all cancers in women worldwide (25%). Annually about one million women are diagnosed with breast cancer worldwide[1]. Breast cancer accounts for maximum number of deaths in the age group of 15-54 years[2]. There is an increased trend in the detection of breast carcinoma, which can be attributed to increased mammographic screening and changes in lifestyle[3]. But the mortality has decreased due to early screening, which detects the tumor at an early curable stage and also by means of better effective treatment modalities. Nowadays the incidence of breast carcinoma has increased in less developed countries owing to gradual changes in lifestyle of women[4].

Ultrasound is a helper tool used in union with mammography and clinical examination of breast in breast lesion screening. In patients with dense breast tissue, USG is a valuable aid in picking up and characterizing lesions. It has a highly capable in spotting lesions but is poor in specificity. To boost specificity, the ACR introduced the BIRADS to categorize breast masses. However BI-RADS resulted in an increase in biopsies performed causing unnecessary discomfort, anxiety and increased cost to the patient. The drawback of B mode USG is higher false-positive rate and low positive predictive value[5].

Prompt detection is the foundation to control breast cancer. A dependable imaging method that can be used for detection of carcinoma breast has to be established. Breast cancer is a heterogeneous disease with distinct biological subtypes. Major types include invasive ductal carcinoma and invasive lobular carcinoma. Of these, invasive ductal carcinoma is the most common subtype accounting for 70-80%, it is further sub classified as well differentiated (grade1), moderately differentiated (grade-2) and poorly differentiated (grade-3) based on levels of nuclear pleomorphism, tubular formation and mitotic index[6]. The prognostic factors include clinical variables like age, menopausal status etc., and pathological variables like tumour size, histological type, histological grade and lymph node status. [7]

MATERIAL AND METHODS

This is a prospective and observational study conducted in the Department of Radiology, Al-Ameen medical college and Hospital from October 2021 to September 2022 presenting with complaints of palpable breast lesions and referred to the Department of radiology.

Inclusion Criteria:
1. All female patients of any age group presenting with lump in the breast
2. Patient referred to radiology department with breast lesions.
3. Patients with asymptomatic, non-palpable lesions in the breast, detected by HRUSG.

Exclusion Criteria:

1. Patient who has already underwent FNAC study.
2. Previously diagnosed cases of benign disease or of carcinoma of the breast.
3. Patients undergoing treatment and returning to the radiology department for follow up of the residual or recurrence of disease.
4. Patient unwilling to undergo ultrasound scan along with FNAC.

Method of Data Collection:
This was a prospective study conducted at tertiary care institute after obtaining institutional ethics committee board approval and informed consent was obtained from all the subjects prior to the start of the study. Structured proforma was used to collect the data. All the subjects who fulfilled the inclusion criteria were subjected to ultrasonography and FNAC. A high-resolution duplex Doppler sonography study using HITACHI ALOKA F-37 ultrasound machines with 5-13MHz linear transducer will be done. On ultrasound examination size, shape, margins, calcifications, Orientation, Echogenicity, posterior acoustic features, Lesion boundary, vascularity and axillary lymph nodes were accessed.

Statistical analysis:
Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data.
Continuous data was represented as mean and standard deviation.
Graphical representation of data: MS Excel and MS word were used to obtain various types of graphs such as bar diagram, Pie diagram.

RESULTS
1: Family History of Breast Cancer distribution

		Count	%
Family History of Breast Cancer	Yes	10	20.0%
	No	40	80.0%
	Total	50	100.0%

In the study 20% had Family History of Breast Cancer.

Table 2: USG Margin distribution

		Count	%
USG Margin	Circumscribed	22	44.0%
	Indistinct	8	16.0%
	Micro lobulated	14	28.0%
	Spiculated	6	12.0%
	Total	50	100.0%

In the study on USG, margin was Circumscribed in 44%, 16% had indistinct, 28% had Micro lobulated and 12% had Spiculated.

Table 3: Echogenicity distribution

	Count	%

Echogenicity	Anechoic	12	24.0%
	Hypoechoic	33	66.0%
	Isoechoic	1	2.0%
	Hyperechoic	0	0.0%
	Complex cystic and solid	4	8.0%
	Total	50	100.0%

In the study on USG Echogenicity was Hypoechoic (66%), anechoic (24%), Complex cystic and solid (8%) and Isoechoic (2%).

Table 4: Posterior Echo Intensity distribution

		Count	%
Posterior Echo Intensity	Post acoustic Enhancement	9	18.0%
	Shadowing	15	30.0%
	No posterior features	26	52.0%
	Total	50	100.0%

In the study on USG Posterior Echo Intensity was Post acoustic Enhancement in 18%, Shadowing in 30% and No, posterior features in 52%.

Table 5: Underlying Muscle and Chest wall distribution

		Count	%
Underlying Muscle and Chest wall	No infiltration	48	96.0%
	Infiltration	2	4.0%
	Total	50	100.0%

In the study the study 96% had no infiltration and 4% had infiltration.

Table 6: Sono-BIRADS findings distribution

		Count	%
Sono-BIRADS	Negative	0	0.0%
	Benign	23	46.0%
	Probably benign	12	24.0%
	Suspicious of malignancy	7	14.0%
	Highly suspicious of malignancy	8	16.0%
	Total	50	100.0%

In the study on Sono BIRADS, 46% were benign, 24% were Probably benign, 14% were Suspicious of malignancy and 16% were Highly suspicious of malignancy.

Table 7: Association between BIRADS classification and USG findings

		BIRADS				P value
		Malignant		Benign		
		Count	%	Count	%	
USG Shape	Oval	2	13.3%	22	62.9%	0.001*
	Round	13	86.7%	13	37.1%	
USG Margin	Circumscribed	2	13.3%	20	57.1%	<0.001*
	Indistinct	1	6.7%	7	20.0%	
	Micro lobulated	6	40.0%	8	22.9%	
	Spiculated	6	40.0%	0	0.0%	
Echogenicity	Anechoic	0	0.0%	12	34.3%	0.052
	Hypoechoic	13	86.7%	20	57.1%	
	Isoechoic	0	0.0%	1	2.9%	
	Hyperechoic	0	0.0%	0	0.0%	
	Complex cystic and solid	2	13.3%	2	5.7%	
Posterior Echo Intensity	Post acoustic Enhancement	0	0.0%	9	25.7%	0.004*
	Shadowing	9	60.0%	6	17.1%	
	No posterior features	6	40.0%	20	57.1%	
Longitudinal versus anteroposterior diameter ratio	Yes	3	20.0%	23	65.7%	0.003*
	No	12	80.0%	12	34.3%	
Overlying Skin	Normal	10	66.7%	34	97.1%	0.001*,
	Skin retraction	5	33.3%	0	0.0%	
	Skin thickening	0	0.0%	1	2.9%	
Underlying Muscle and Chest wall	No infiltration	13	86.7%	35	100.0%	0.027*
	Infiltration	2	13.3%	0	0.0%	

In the study there was significant association between Shape, Margin, Posterior Echo Intensity, Longitudinal versus anteroposterior diameter ratio, Overlying Skin and Underlying Muscle and

Table 8: Association between FNAC classification and USG findings

		FNAC				P value
		Malignant		Benign		
		Count	%	Count	%	
USG Shape	Oval	2	12.5%	22	64.7%	0.001*
	Round	14	87.5%	12	35.3%	
USG Margin	Circumscribed	1	6.2%	21	61.8%	<0.001*
	Indistinct	2	12.5%	6	17.6%	
	Micro lobulated	7	43.8%	7	20.6%	

	Spiculated	6	37.5%	0	0.0%	
Echogenicity	Anechoic	0	0.0%	12	35.3%	0.039[*]
	Hypoechoic	14	87.5%	19	55.9%	
	Isoechoic	0	0.0%	1	2.9%	
	Hyperechoic	0	0.0%	0	0.0%	
	Complex cystic and solid	2	12.5%	2	5.9%	
Posterior Echo Intensity	Post acoustic Enhancement	0	0.0%	9	26.5%	0.001[*,]
	Shadowing	10	62.5%	5	14.7%	
	No posterior features	6	37.5%	20	58.8%	
Longitudinal versus anteroposterior diameter ratio	Yes	2	12.5%	24	70.6%	<0.001*
	No	14	87.5%	10	29.4%	
Overlying Skin	Normal	11	68.8%	33	97.1%	0.002*
	Skin retraction	5	31.2%	0	0.0%	
	Skin thickening	0	0.0%	1	2.9%	
Underlying Muscle and Chest wall	No infiltration	14	87.5%	34	100.0%	0.035[*]
	Infiltration	2	12.5%	0	0.0%	

In the study there was significant association between Shape, Margin, Echogenicity, Posterior Echo Intensity, Longitudinal versus anteroposterior diameter ratio, Overlying Skin and Underlying Muscle and Chest wall between benign and malignant lesions based on FNAC.

DISCUSSION

Ultrasound is a safe and widely available imaging modality for diagnostic evaluation of breast lesions, in addition to mammography. [8] Primarily, breast ultrasound has been used to differentiate benign and malignant lesions. However, many studies have also looked at utilizing the tissue information available with ultrasound to differentiate various grades of malignancy in breast carcinomas. [9] Features of masses on ultrasound as abrupt interface of tumor, complex solid cystic mass with heterogeneous echotexture, and presence of suspicious calcifications were evaluated.

In the present study, micro lobulation was seen in 43.8% of malignant cases and in 20.6% of benign lesions. There was significant difference in lobulation b/w malignant and benign lesions. A few gentle well circumscribed populations (macrolobulation) were considered a benign feature, whereas many small lobulations (microlobulation) of 1-2 mm were considered a malignant characteristic by **Stavros et al.**.[10] They observed microlobulation to have a specificity, sensitivity, and accuracy of 83.8, 75.2%, % and 82.4% respectively for association with malignancy. **Robin S et al.**[11] reported 27.3% of carcinomas and 10.6% of fibro adenoma to have microlobulation.

In the present study, circumscribed or smooth margins were seen in 6.2% of the malignant lesion and 61.8% of benign lesions. Circumscribed margin is one with an abrupt transition

between lesion and the surrounding tissue. **Chala et al.**[12] reported frequency of 9.6% in malignant masses, 78.5% in benign masses with positive predictive value of 3.5% for malignancy. **Dimri G al.** [13] reported frequency of 91% in benign masses and 9% in malignant masses.

In the present study, shadowing was present in 62.5% of malignant and 14.7% of the benign lesions and enhancement was present in 0% of malignant and 26.5% of benign lesions. Posterior Echo Intensity was classified as showing posterior acoustic enhancement and shadowing[14]. Shadowing is the result of attenuation of sound beam by desmoplastic host response to breast cancer rather than being tumor to itself and was suggestive of malignancy[15]. In contrast posterior acoustic enhancement or absent distal sound beam modulation were non-specific findings[16]. **Rahbar et al.** [13] reported frequency for attenuation of 75% in benign masses.

In the present study, among malignant lesions, 87.5% of malignant lesions were hypo echoic, 12.5% had Complex cystic and solid, among benign lesions 55.9% of were hypo echoic, 35.3% had Anechoic, 2.9% had Isoechoic and 5.9% had Complex cystic and solid. Echogenicity has been of less importance for the differentiation of solid masses, partly due to lack of standardized definition of the parameter exists and is the most operator dependent. [17] **Robin S et al.**[11] reported 94% of fibro adenoma 92% of invasive carcinomas to be hypo echoic. **Stavros et al.** [10] reported 68.8% of malignant lesions to be hypo echoic and all benign lesions to be hyper echoic.

A lexicon of sonographic descriptors of breast masses with assessment categories (Breast Imaging and Reporting and Database System [BI-RADS] has been developed by the American College of Radiology (ACR; Reston, VA) to enhance the clinical efficacy of breast sonography and to standardize terms used for lesion characterization and reporting. The sonographic BI-RADS lexicon includes descriptors used for shape, orientation, margins, lesion boundary, echo pattern, posterior acoustic features, and surrounding tissue alterations. On the basis of these sonographic descriptors, each lesion was assigned to a final assessment category[18.]

The selection of an appropriate treatment plan for patients with breast carcinoma is determined by accurate assessment of tumor size, involvement of nipple or pectoralis muscle, multifocal disease and metastasis of axillary node. The sensitivity of ultrasound BIRADS grading for the detection of index lesions was 90.9 % and specificity was 85.7 % in our study. The positive predictive value was 83.3 % and negative predictive value was 92.3 %.

The sensitivity of the present study was slightly lower than recorded by various studies and **Chao et al.** [19] **Berg et al.** [20] The p values for most of the variables were calculated to obtain their significance in differentiating benign and malignant lesions. All ultrasound morphological features were significant.

CONCLUSIONS
From the study it was concluded that High-Resolution Ultrasonography (BIRADS) had Sensitivity of 81.25%, specificity of 94.12%, PPV of 86.67%, NPV of 91.43%, Diagnostic Accuracy was 90%. Thus, USG is a reliable first line investigation in cases of breast lesions due to its good sensitivity and a primary diagnosis can be arrived at and the need

for other investigations such as FNAC and Biopsy can be decided upon. Characteristics of Breast lesions on USG also helps in differentiation of Benign and malignant lesions. Hence plays role in differentiation of benign and malignant lesions.

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