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Role of Ultrasound in Evaluation of Breast Lesions and its FNAC Correlation at a Tertiary Hospital

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Abstract

Background: Diagnosis of breast cancer has been widely improved since the development of high-resolution ultrasound. Ultrasonography is an indispensable tool in breast imaging. FNAC is relevant and important for pre-operative pathological evaluation of in management of breast cancer. Present study was aimed to study ultrasound guided evaluation of breast lesions followed by correlation of its findings with FNAC (cytopathological correlation). **Material and Methods:** Present study was single-center, prospective, observational study, conducted in females, age > 18 years, complaining of palpable breast lesions, OR had suspicious lesions on mammography. BIRAD score interpreted by USG was used for prediction of malignancy. **Results:** In present study, 233 women were included. Majority were from 31-60 years age group, with mean age of 47.22 ± 11.43 years. Common indication for USG were lump (71.2 %) followed by pain (16.3 %), screening (7.7 %) & nipple discharge (4.7 %). FNAC report was Malignant (56.7 %) in majority cases as compared to benign (43.3 %). Sensitivity and Specificity of BIRAD ≥ IVb was highest (90.9 % & 89.1 % respectively) followed by BIRAD ≥ IVa (88.6 % & 75.3 % respectively) & BIRAD ≥ IVc (71.2 % & 95.1 % respectively). No statistically significant difference was noted between oval and round shape (p- 0.859). Benign lesions on FNAC were commonly seen with Circumscribed margins (64.4 %) while malignant lesions on FNAC were commonly seen with microlobulated margins (57.6 %), association was statistically significant (p<0.001). **Conclusion:** Using integrated approach employing imaging and FNAC (cytological method) procedure is the best way to in addressing the diagnostic needs of patients with breast diseases.

Keywords: FNAC, Ultrasonography, BIRADS, breast lesions.

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Introduction

Diagnosis of breast cancer has been widely improved since the development of high-resolution ultrasound. Breast cancer is leading cause of cancer in females, and is the leading cancer related cause of death in this group. [1] Ultrasonography is an indispensable tool in breast imaging and is complementary to both mammography and magnetic resonance

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imaging. Ultrasound improves the differential diagnosis of benign and malignant breast lesions, local staging and guided interventional diagnosis.[2]

FNAC is relevant and important for pre-operative pathological evaluation of in management of breast cancer. With FNAC procedure diagnosis is quick, cost effective and relatively painless as compared to biopsy. FNAC is operator dependant procedure and reporting of breast cytological results is more demanding than histopathological analysis.

Ultrasound (US) evaluation of the breast can be categorized as either diagnostic or screening. The primary goal of screening is to detect breast cancer in large populations of asymptomatic patients. On the other hand, the primary goal of diagnostic breast ultrasound is to characterize either abnormalities that have already been detected by screening mammography or palpable abnormalities.[3] Present study was aimed to study ultrasound guided evaluation of breast lesions followed by correlation of its findings with FNAC (cytopathological correlation).

Material And Methods

Present study was single-center, prospective, observational study, conducted in department of Radio-diagnosis, at Dr V.M. government medical college & hospital, Solapur (Maharashtra), India. Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Females, age > 18 years, complaining of palpable breast lesions, OR had suspicious lesions on mammography, willing to participate in present study.

Exclusion criteria

- All patients who did not give consent to be part of this STUDY.
- Pregnant and lactating patients.
- Patients with inflammatory breast lesions
- Patients for whom FNAC study could not be performed will be excluded from the study.

Study was explained to patients in local language & written consent was taken for participation & study. Sample size was calculated by considering Sensitivity of BIRADS score. The minimum required sample was 232. Demographic data (age and address) along with complaints, detailed history of previous operation, similar complaints in past, family history of breast cancer were noted. Using Philips Affinity 70 and Philip's HDXE 11 ultrasound machines, the USG was performed with the patient lying in supine position. The high frequency linear probe (Transducer 5-7 MHz) had been used to image the breast tissues. Both the breasts were exposed and the transducer was swept in radial and anti-radial direction to look for abnormalities.

FNAC Fine needle aspiration cytology (FNAC) of the lesion was performed under ultrasound guidance. The skin disinfection done with the disinfectant. The needle was inserted near one of the side of the transducer and then it was advanced along a trajectory which is lying parallel to the long axis of the transducer. Until the lesion was penetrated, the needle was visualized on the monitor in real time. Aspiration was applied and the tip was moved in various directions to collect multiple samples. When the needle was being withdrawn, no aspiration applied. The collected specimen then sent for histopathological examination which was examined by the pathologist.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

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BIRAD score interpreted by USG was used for prediction of malignancy. The accuracy of this prediction at various cut off values of BIRAD score was estimated by calculating sensitivity (true positive rate) specificity (true negative rate), Positive predictive value (probability that the disease is present when the test is positive) and Negative predictive value (probability that the disease is not present when the test is negative). A receiver operating characteristic curve, or ROC curve, which is a graphical plot that illustrates the diagnostic ability of a binary classifier system as its discrimination threshold is varied was plotted and Area under the curve was calculated for each cut off value of BIRADS Score.

Results

In present study, 233 women were included. Majority were from 31-60 years age group, with mean age of 47.22 ± 11.43 years. Common indication for USG were lump (71.2 %) followed by pain (16.3 %), screening (7.7 %) & nipple discharge (4.7 %).

Table 1: General characteristics

	No. of patients	**Percentage**
Age groups (in years)		
≤ 30 Years	23	9.87
31-60 years	175	75.11
60-90 years	35	15.02
Mean age (mean ± SD)	47.22 ± 11.43	
Indication for USG		
Screening	18	7.7
Pain	38	16.3
Lump	166	71.2
Nipple Discharge	11	4.7

Common location of lesion was upper outer quadrant (41.6 %) & lower outer quadrant (33.9 %). Majority of lesions were oval (51.5 %), had Microlobulated (35.6 %) & Circumscribed (29.6 %) margins of lesion. Common echogenicity was Hypoechoic (60.9 %) followed by Hyperechoic (17.6 %), Anechoic (9.4 %) & Isoechoic (9 %). Posterior features of lesion were Post acoustic Enhancement (27.9 %) & Shadowing (51.5 %).

Table 2: Radiological characteristics

	No. of patients	**Percentage**
Location of lesion		
Upper outer quadrant	97	41.6
Upper inner quadrant	23	9.9
Lower inner quadrant	34	14.6
Lower outer quadrant	79	33.9
Shape of lesion		
Oval	120	51.5
Round	113	48.5
Margins of lesion		
Circumscribed	69	29.6
Microlobulated	83	35.6
Spiculated	45	19.3
Indistinct	36	15.5
Echogenicity		
Anechoic	22	9.4
Hypoechoic	142	60.9

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Hyperechoic	41	17.6
Isoechoic	21	9.0
Complex solid and cystic lesion	7	3.0
Posterior features of lesion.		
Post acoustic Enhancement	65	27.9
Shadowing	120	51.5
No posterior features	48	20.6

Skin thickening (30.9 %) & Skin retraction (28.8 %) was noted in majority cases. Invasion of lesion was noted in 95 cases (40.8 %). FNAC report was Malignant (56.7 %) in majority cases as compared to benign (43.3 %).

Table 4: Pathological characteristics

	No. of patients	**Percentage**
Skin		
Normal	94	40.3
Skin thickening	72	30.9
Skin retraction	67	28.8
Invasion of lesion.		
No invasion	138	59.2
Invasion	95	40.8
FNAC report.		
Benign	101	43.3
Malignant	132	56.7
USG-FNAC correlation		
Concordance	222	95.3
Discordance	11	4.7
BIRAD grade		
Negative (I)	7	3.00
Benign (II)	46	19.74
Probably benign (III)	31	13.30
suspicious of malignancy IV-low suspicion (IVa)	18	7.73
Moderate suspicion (IVb)	32	13.73
High suspicion (IVc)	55	23.60
Highly suggestive of malignancy (V)	44	18.88

Sensitivity and Specificity of BIRAD ≥ IVb was highest (90.9 % & 89.1 % respectively) followed by BIRAD ≥ IVa (88.6 % & 75.3 % respectively) & BIRAD ≥ IVc (71.2 % & 95.1 % respectively).

Table 5: Sensitivity and Specificity of different BIRAD Scores in prediction of malignancy

BIRAD scores	**Sensitivity**	**Specificity**
BIRAD ≥ III	93.9%	44.6%
BIRAD ≥ IVa	88.6%	75.3%
BIRAD ≥ IVb	90.9%	89.1%
BIRAD ≥ IVc	71.2%	95.1%
BIRAD ≥ V	32.6%	99.0%

No statistically significant difference was noted between oval and round shape (p- 0.859).

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Table 6: Distribution of Lesion shapes Stratified by FNAC Diagnosis

Shape	FNAC Diagnosis		p
	Benign (N=101)	Malignant (N=132)	
Oval	53 (52.5%)	67 (50.8%)	0.859
Round	48 (47.5%	65 (49.2%	

Benign lesions on FNAC were commonly seen with Circumscribed margins (64.4 %) while malignant lesions on FNAC were commonly seen with microlobulated margins (57.6 %), association was statistically significant (p<0.001).

Table 20: Distribution of Lesion Margins Stratified by FNAC Diagnosis

Margins	FNAC Diagnosis		p
	Benign (N=101)	Malignant (N=132)	
Circumscribed	65 (64.4 %)	4 (3 %)	<0.001
Microlobulated	7 (6.9 %)	76 (57.6 %)	
Spiculated	19 (18.8 %)	26 (19.7 %)	
Indistinct	10 (9.9 %)	26 (19.7 %)	

Benign lesions on FNAC were commonly seen with radiological echogenicity such as Hypoechoic (68.3 %) followed by Hyperechoic (16.8 %) & Isoechoic (14.9 %). Malignant lesions on FNAC were commonly seen with radiological echogenicity such as hypoechoic (55.3 %) followed by hyperechoic (18.2 %), anechoic (16.7 %), complex solid and cystic lesion (5.3 %) & isoechoic (4.5 %).

Table 8: Distribution of Echogenicity Stratified by FNAC Diagnosis

Echogenicity	FNAC Diagnosis		p
	Benign (N=101)	Malignant (N=132)	
Anechoic	0	22 (16.7 %)	<0.001
Hypoechoic	69 (68.3 %)	73 (55.3 %)	
Hyperechoic	17 (16.8 %)	24 (18.2 %)	
Isoechoic	15 (14.9 %)	6 (4.5 %)	
Complex solid and cystic lesion	0	7 (5.3 %)	

Discussion

The general role of diagnostic breast ultrasound is to make a non-invasive diagnosis in patients who have clinical or mammographic abnormalities than could be achieved with mammography and clinical findings alone. The use of breast ultrasound in patients (those who have clinical or mammographic findings that are not clearly malignant) should increase the certainty of a benign diagnosis in many patients and should increase the suspicion of carcinoma in a small number of patients.[4]

Mammography is capable only of showing four different densities (air, water, fat, and calcium) and can further distinguish between different water-density tissues only by differences in thickness and compressibility and by whether the tissues contain some fatty or calcium density. Ultrasound, on the other hand, can distinguish among many different types of normal breast tissue. Like mammography, ultrasound can identify air, fat, calcium densities. However, unlike mammography, ultrasound can also differentiate among different types of normal water-density tissues by echogenicity as well as thickness and elasticity.[5]

High resolution ultrasonography is a useful diagnostic modality for evaluation of various breast lumps. It is sensitive for microcalcifications, intraductal lesions and has good sensitivity, specificity, positive and negative predictive values for diagnosing breast lesions.

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Ultrasound is cheap, easily available, with no risk of ionising radiation. So, it is useful investigation for follow up of indicated lesions. The FNAC of breast is cheap, less invasive, safe and highly accurate method for diagnosis of breast lesions. Many benign conditions, infections, degenerative conditions are easily detected by FNAC. So, no further invasive investigations can be avoided.

Almost 55.3% of hypoechoic lesions were malignant on fine needle aspiration cytology followed by hyperechoic and solid cystic lesions. Some benign lesions also were hypoechoic but they lacked other characteristic features like irregular or spiculated margins, skin invasion and posterior features typical of malignancy.

In our study, all the lesions which had a longitudinal versus anteroposterior diameter ratio of more than one was came to be benign on FNAC. The lesions those not fulfilling the criteria were almost equally either benign or malignant. From this study we can conclude that a lesion having a ratio of longitudinal to AP diameter of more than 1 were benign. These findings are similar to a study done by Chaitanya INVL et al.,[6] a round lesion with well-circumscribed margins, a longitudinal to AP diameter ratio which was greater than or equal to one with no hypoechogenicity when seen were most probably considered benign lesion on ultrasonography. Most of the cases that were given a grade of BI-RADS 5 had positive malignant ipsilateral lymph adenopathy which were enlarged rounded with loss of fatty hilum. In our study, the positive predictive value was 97.7 % and the negative predictive value was 52.9 % on ultrasonography.

In 95.3 % cases there was concordance of findings between ultrasonography and FNAC findings. It was concluded from the cases which we labelled BIRADS IV or V and these cases which came malignant on FNAC. The discordance is seen in around 4.7 % cases. These were the cases which showed the benign features on ultrasound like well circumscribed margins without significant internal vascularity, no obvious underlying chest wall invasion. Specificity of detecting BIRADS V lesion were turned to be highest i.e., 99 % on ultrasound, with the lesions showing hyperechoic foci i.e., microcalcifications, microlobulated margins, obvious underlying pectoralis invasion and overlying skin invasion.

Ravi Kumar Marri et al.[7] noted that most of the cases 35 (63.6 %) were in the upper outer quadrant of the breast. There were (BI-RADS) 45 (81%) lumps were reported as benign lesions and 07 (12.7 %) as malignant and 3 (5 %) were reported as features suggestive or suspicious for malignancy. Similar findings were noted in present study.

Hiral Hapani et al,.[8] noted that 52% cases showed circumscribed margins (all were benign) followed by 12% Spiculated margins. Among the 64% cases appearing hypoechoic, 76.56% came benign and remaining 23.43% were reveal malignant. 51% of benign lesions showed posterior enhancement while 70% of malignant lesions showed posterior acoustic shadowing.

Rahman S, Sultana N et al. in jan2014 studied [70] Ultrasonography in diagnosis of malignant breast lesions, sensitivity was proven to be 86%, specificity was about 92.9%, with positive predictive value (PPV) (96%), negative predictive value (NPV) 72.2% and accuracy was 88 % as comparable to other similar studies.

Jahan Ab ahmed Mu et al,.[9] sensitivity was proven to be 80.0%, specificity 96%, positive predictive value (PPV) (88.89%), negative predictive value 94.12% and the accuracy was 93.02% and comparable to other study. In diagnosis of benign breast lesion by ultrasound, sensitivity was about 96 %, specificity of 80%, positive predictive value (94.12%), negative predictive value (NPV)88.89% and accuracy was 93.02%.

USG is an appropriate imaging method for reliable diagnosis of diagnosis of palpable breast mass.[10,11] Imaging with ultrasonography combined with FNAC yielded the best results showed the sensitivity of 94% for benign lesions and 96% for malignant lesions, while the specificity was 97% for benign lesions and 92% for malignant lesions. The detection of

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malignancy was proven to be more accurate when both the modalities were combined in our study group. Our results were slightly different from other studies which evaluated the sensitivity of radiological grading in predicting malignancy. It is concluded that imaging with ultrasonography and FNAC yielded a better result than with either modality in helping in more accurate characterization of lesions in the breast and to categorise breast lesions as benign and malignant.

Conclusion

Using integrated approach employing imaging and FNAC (cytological method) procedure is the best way to in addressing the diagnostic needs of patients with breast diseases. Ultrasonography BIRADS combined with FNAC gives the excellent results. Hence Ultrasonography can safely be used as the first line investigation for evaluation of breast lump

FNAC correlation of ultrasound findings revealed a high degree of sensitivity and specificity in differentiating benign from malignant lesions and obviated need for more invasive procedures like core biopsy and investigations like MRI.

Conflict of Interest: None to declare
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