An Ultrasound Evaluation of Breast Lumps with Fine Needle Aspiration Cytology Correlation in a Tertiary Medical Centre at South Bihar

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ABSTRACT

BACKGROUND

In clinical practice, breast lump is a very common presentation of numerous breast diseases which ranges from benign cysts to malignant lesions. The difference between benign and malignant is very important for patient care and proper management. The diagnosis of breast lump includes clinical examination supplemented by imaging. Various literature has concluded that ultrasound evaluation with fine needle aspiration cytology (FNAC) correlation has comparable sensitivity and specificity to histopathology. Our aim was to study the ultrasonographic characteristics of breast lesions in patients and compare the sensitivity of ultrasonography in diagnosing benign and malignant breast lesions with FNAC.

METHODS

This is a diagnostic validation study, conducted at Department of Radiodiagnosis and Department of Pathology, Narayan Medical College and Hospital. All females more than 30 years coming for routine breast screening, found to have Breast Imaging Reporting and Data System (BI-RADS) 2 and above were subjected to ultrasonography and FNAC under ultrasonography (USG) guidance, and compared with histopathology. Data was collected, entered and analysed using Microsoft Excel, Epi Info, and SPSS software. Sensitivity and specificity with correlation, positive predictive value (PPV), negative predictive value (NPV) was calculated to compare the two diagnostic modalities.

RESULTS

USG had 83.3 % sensitivity, 97.56 % specificity, 95.24 % positive predictive value, 90.91 % negative predictive value, 33.32 % positive likelihood ratio and 17.13 % negative likelihood ratio. FNAC had 96.67 % sensitivity, 97.56 % specificity, 96.67 % positive predictive value, 97.56 % negative predictive value, 38.66 % positive likelihood ratio and 3.42 % negative likelihood ratio.

CONCLUSIONS

Breast ultrasound and FNAC both are important diagnostic tools for breast lesion. Sensitivity, specificity and other features are better for FNAC than ultrasound for breast lump.

KEYWORDS

Breast Lump, FNAC, USG, Adenocarcinoma, Squamous Cell Carcinoma

BACKGROUND

In clinical practice breast lump is a very common presentation of numerous breast diseases which ranges from benign cysts to malignant lesions. The difference between benign and malignant is very important for patient care and proper management. Clinical assessment is the first step in assessment of breast lump but there is always a chance of mistake if diagnosis is made on clinical basis alone. There are a variety of diagnostic modalities available for the assessment of breast lump.[1]

However, developed and developing countries had different incidence, being more in developed countries (> 80 per 100,000 populations) than that in developing regions of the world (< 40 per 100,000 populations). In the US it has been emphasised that women older than 40 years of age are the most affected victims of breast cancer. Nevertheless, that is not the condition in developing countries where younger patients form a major health burden. Early detection and treatment remains the best method for preventing death and dissemination of breast cancer from spreading.[2]

As carcinoma breast incidence is increasing, diagnostic accuracy is becoming more and more important. The triple approach has very high level of diagnostic accuracy for breast lesion. Triple approach includes imaging, clinical examination and FNAC.[3]

Recent works reveals that the breast USG has comparable result to detect and predict malignancy in an impalpable stage which are curable in 90 % of cases. Breast cancer affects Indian woman in younger age (45 - 54 years), an age where breast USG become more effective. Though rare, infection like tuberculosis in breast sometimes mimic carcinoma of breast, and to differentiate them, USG guided FNAC is a more reliable tool than mammography.[4]

The decade of 70s demonstrate a receding trend of using breast ultrasound, and even a decade after 70 ultrasounds were relegated in differentiating between solid masses from cystic masses. But, due to increased resolution and quality of USG image, usage of ultrasound is increasing again. With advancement of technology, particularly with 7.5 - 13 MHz probes, there is a completely new facet in USG breast imaging.[5]

However, now a day's fine needle aspiration cytology has become very important in the management of palpable breast masses and becoming popular as an important tool in assessment of breast masses preoperatively. Due to its fast and easy approach, being inexpensive, and having little complications it has become very popular.

FNAC plays a major role in these three areas:
a) For diagnosing benign disease in palpable breast lumps.
b) Staging of breast carcinoma, more commonly in preoperative axillary lymph nodes.
c) Diagnosis of metastatic cases at distant sites after treatment of carcinoma.[6]

FNAC is one of the important diagnostic method, if it is done with all the due precautions and good quality conditions are maintained in taking the samples. FNAC is cheaper than the histopathological techniques and is accessible by physicians without a high technological development. FNAC is a less traumatic procedure for the patient and the results may be available in less time. There must be a strong working arrangement between radiologist and pathologist and combined approach should be present for better output. With this background we have conducted this study having the following aims and objectives.

Objectives
1. To study the ultra-sonographic characteristics of breast lesions in patients.
2. To compare the sensitivity of ultrasonography in diagnosing benign and malignant breast lesions with FNAC.

METHODS

This is a diagnostic test validation study conducted at Narayan Medical College and Hospital. Sample size was calculated based on previous prevalence of breast lumps, it was found in previous study that India accounts for 7 % of global burden of breast lumps. (Takalkar UV et al) With the maximum error in the estimate we were willing to tolerate, say ± 6 %, at 2-sided test with 95 % confidence level (α = 5 %) and design effect = 1, expected sample size was 70 patients, so a total of 70 sample size was taken.

Following formula is used to compute sample size.

$$n = deff * Npq / (d2 / z2 * (N - 1) + pq)$$

All 70 patients after localising the suspicious lesion by ultrasound were referred for FNAC which was performed by specialised cytopathologist using either palpation or under ultrasound guide for the suspicious area. After aspiration, the sampled cells were stained by Papanicolaou and examined cytologically for any atypical, suspicious or malignant cells. Findings of both USG and FNAC was assessed and compared with histopathological findings.

Inclusion Criteria
1. Females more than 30 years of age attending for routine breast screening, found to have BI-RADS 2 - 5.
2. Females with or without lump or nodularity in the breast.
3. Females with complaints of pain in the breast referred to Department of Radiodiagnosis.
4. Females with history of nipple discharge.

Exclusion Criteria
1. Pregnant women
2. Bleeding disorders

Institutional human ethical committee permission was obtained. All patients were subjected to ultrasonography and FNAC under USG guidance.

Ultrasonography

All patients included in the study underwent USG by using Philips Affinity 70 G ultrasound machine, the USG was done with the patient lying in supine position. The high frequency linear probe (Transducer VF 10 - 5) was used to image the breast tissues clearly. Both the breasts was exposed and the transducer was swept in radial and anti-radial direction to look for any abnormality.

FNAC

Fine needle aspiration cytology of the breast lump was performed under ultrasound guidance. The skin was cleaned and draped, the needle was inserted near one of the short sides of the transducer and it is followed along a trajectory line parallel to the transducer long axis. Until the lesion was penetrated, the needle was continuously visualised on the monitor as it advanced towards the lesion. Aspiration was applied and the tip was moved in various directions to collect multiple samples. No aspiration was allowed while the needle was withdrawn. The collected specimen was sent for cytopathological examination.

Statistical Analysis

Data was collected, entered and analysed with the help of various software's such as Microsoft Excel, Epi Info, SPSS software. Sensitivity and specificity with correlation, PPV, NPV was calculated to compare the two diagnostic modalities.

RESULTS

Total 70 patients were included in the study. The mean age of study subjects were 42.46 ± 9.77 yrs., with range of 30 - 70 yrs. 35 out of 70 had left sided lump, 32 had right sided whereas 3 had bilateral so total 73 breast lump was considered. 36 out of 73 had lump in upper outer quadrant, 14 had lump in central area, 10 had left inner quadrant, 9 had left outer quadrant, and 4 had upper inner quadrant.
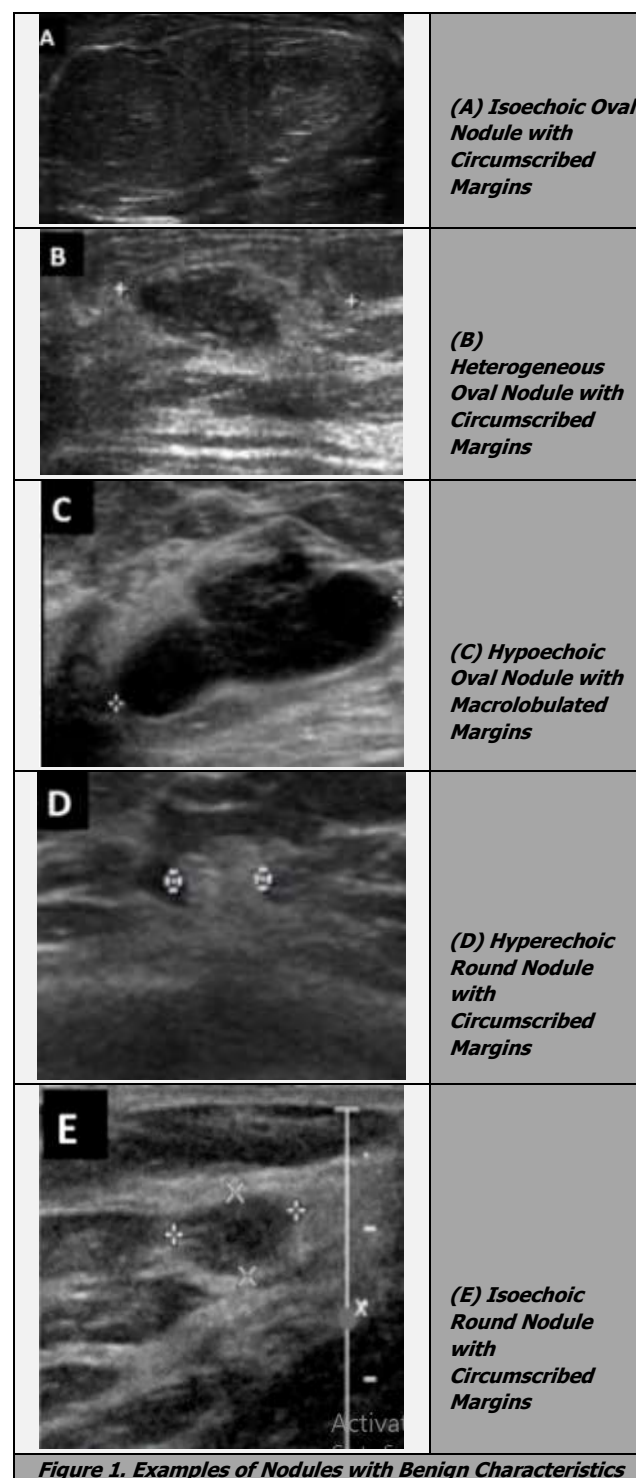
The duration of lump in the study subjects was 12.66 ± 10.35 month and size of lump was 5.36 ± 3.01 cm. 14 out of 70 study subjects had pain in the affected breast, 25 (35.71 %) had discharge from the affected breast.

	Histopathological Examination		
Ultrasonography	Malignant	Benign	Total
Malignant	20	1	21
Benign	4	40	44
Total	24	41	65

Table 1. Ultrasonographic Examination Compared with Histopathological Examinations

McNemar chi-squared statistic is 37.097561. Corresponding P-value is < 0.001, no significant difference. In our study USG of 73 breast were done. Out of total 73 breast lumps assessed, 44 (60.27 %) were having benign lesion and 21 (28.77 %) were having malignant lesion. Six (8.22 %) subjects report were inconclusive and in 2 (2.74 %) cases, ultrasound was not able to detect the breast lump. The inconclusive cases and cases where USG could not

detect the lump were excluded from the calculation. Hence, finally 65 cases were considered. Of these 24 cases were malignant and 41 cases were benign on histopathological examination (HPE). On applying McNemar's test we found McNemar chi square value was 37.09 with P value < 0.001, with significant difference between two groups. i.e., ultrasonography and histopathology significantly varied from each other in differentiating between benign and malignant lesion.

(A) Isoechoic Oval Nodule with Circumscribed Margins

(B) Heterogeneous Oval Nodule with Circumscribed Margins

(C) Hypoechoic Oval Nodule with Macrolobulated Margins

(D) Hyperechoic Round Nodule with Circumscribed Margins

(E) Isoechoic Round Nodule with Circumscribed Margins

Figure 1. Examples of Nodules with Benign Characteristics

On FNAC out of 73 breast lump examined 30 (41.09 %) were malignant, whereas 41 (56.16 %) were benign and in 2 cases the result was inconclusive as they were considered

as "papillary lesion" but final histopathological result, turned out to be "ductal carcinoma in situ. So, two inconclusive cases were not included in the calculation. On applying McNemar test of significance there was no significant difference between FNAC and histopathological examination with P value 1. i.e., there was no significant difference between FNAC and histopathology in diagnosing benign and malignant breast mass.

Histopathological Examination			
FNAC	Malignant	Benign	Total
Malignant	29	1	30
Benign	1	40	41
Total	**30**	**41**	**71**

Table 2. Result of FNAC Examination Compared with Histopathological Examinations

	USG	FNAC
Sensitivity	83.3	96.67
Specificity	97.56	97.56
Positive predictive value	95.24	96.67
Negative predictive value	90.91	97.56
Positive likelihood ratio	33.32	38.66
Negative likelihood ratio	17.13	3.42

Table 3. Comparison between FNAC and USG in the Diagnosis of Malignant Breast Lump

In our study the USG had 83.3 % sensitivity, 97.56 % specificity, 95.24 % positive predictive value, 90.91 % negative predictive value, 33.32 % positive likelihood ratio and 17.13 % negative likelihood ratio, when we considered histopathology as gold standard and compared findings of USG with histopathology. The FNAC had 96.67 % sensitivity, 97.56 % specificity, 96.67 % positive predictive value, 97.56 % negative predictive value, 38.66 % positive likelihood ratio and 3.42 % negative likelihood ratio considering histopathology as gold standard. So on the basis of above results we can say that sensitivity is better for FNAC than USG, having almost equal specificity and better positive predictive value.

DISCUSSION

Breast cancer is the commonest cancer in females worldwide & second commonest after cervical cancer in India. Early detection and screening can reduce breast cancer mortality around 18 - 29 %. Breast ultrasonography and FNAC plays a crucial role in the diagnosis of breast cancer. We had conducted a study to assess the USG and FNAC as diagnostic technique for breast lump. Age is one of the important factor to determine the diagnosis and prognosis of breast lump, as the age increases the chances of malignancy increases. In our study the mean age of study subjects was 42.46 ± 9.77 yrs., with range of 30 - 70 yrs. Other similar studies such as Balasundaram et al[1] in their study age group of 31 - 40 years had highest frequency of lump, but Takhellambam YS[7] found highest breast lump was in 36 - 45 yrs. age group. These results are almost same as our study.

Involvement of a particular area is a specific feature of breast disease. Particular quadrant involvement is characteristic feature of breast disease. In our study 36 out of 73 had lump in upper outer quadrant, 14 had lump in central area, 10 had left inner quadrant, 9 had left outer

quadrant, and 4 had upper inner quadrant. Other similar studies such as by Balasundaram A et al[1] found upper-outer area was mainly involved in 40 % followed by multi quadrant involvement in 18 % cases. This shows the most common involvement is upper quadrant which is in accordance with our study.

The prognosis of breast lump depends on whether it is benign or malignant. In our study 44 (60.27 %) were reported as benign and 21 (28.77 %) as malignant in total 73 subjects. Six (8.22 %) cases were indeterminate and in 2 (2.74 %) cases, ultrasound was not able to detect the breast lump. Study by Tiwari et al[8] found that 83.01 % of breast lesions were benign which is greater than our study. But predominance of benign lesion is in accordance with our study.

The exact diagnosis of breast lesion needs the availability of trained physician; having adequate training in aspiration and interpretation of the findings and well trained technicians to ensure the preparation of quality report.

In our study the USG had 83.3 % sensitivity, 97.56 % specificity, 95.24 % positive predictive value, 90.91 % negative predictive value, 33.32 % positive likelihood ratio and 17.13 % negative likelihood ratio. Mandal A et al[9] in their prospective observational study conducted at West Bengal found that the sensitivity was 85.71 %, specificity was 90.18 %, positive predictive value and negative predictive value of USG in detecting carcinoma breast was 72.41 % and 95.45 % respectively. This finding is almost in accordance with our study. Richie AJ et al[9] in their prospective descriptive study of sonomammography had a sensitivity of 90.6 % and specificity of 97.8 almost similar to our study. Tiwari P et al[8] in their prospective study conducted at Kolkata concluded that the sensitivity was 55.55, specificity was 97.72 %, PPV 83.33 %, and NPV 91.48 % of USG in detecting carcinoma breast.

Zhang F et al[10] in their prospective comparative study conducted in China found that the sensitivity, specificity, accuracy, and positive predictive value (PPV) of ultrasound was 75.0 %, 75.0 %, 75.0 %, and 82.6 %, respectively. These variations amongst the studies may be due to different methods of case selections, varying resolution power of ultrasound equipment used, and may be due to the fact ultrasound is an operator dependent technique and its sensitivity and specificity depends on the training of operator.

In our study The FNAC had 96.67 % sensitivity, 97.56 % specificity, 96.67 % positive predictive value, 97.56 % negative predictive value, 38.66 % positive likelihood ratio and 3.42 % negative likelihood ratio considering histopathology as gold standard. Study by Izumori A et al[11] shows FNAC was done for 232 cases with the findings: sensitivity of 85.7 %, specificity of 91.6 %, PPV of 94.1 %, NPV of 92.9 %, false-negative rate of 14.3 %, false-positive rate of 2.1 %, and accuracy of 89.7 %. Richie AJ et al[12] concluded that FNAC was found to have sensitivity of 98.4 % and specificity of 95.7 %. Zhang A et al[10] found USG-FNAC, sensitivity, specificity, PPV and NPV were 80.8 %, 100.0 %, 88.7 %, and 100.0 %, respectively.

Shrivastava V et al[13] in their prospective study conducted at Allahabad concluded that using axillary ultrasound and

selective US-FNAC is a rapid, non-morbid method of staging the axilla. Laishram S et al[6] conducted a study in Sikkim and found that an "intermediate zone" exists between benign and malignant lesions in FNAC of breast where an unequivocal diagnosis cannot be given. There was significant differences in specificity, accuracy, and PPV between the 2 procedures (P < .05). These variations may be because of different inclusion criteria of breast lump (like size, palpable or non-palpable) in different studies; the sensitivity of the test has also been found to be dependent on the skill and efficiency of operator.

Study by Srivastava V et al[13] shows the sensitivity, specificity, positive predictive value and negative predictive value of USG of breast in comparison with histopathology was found to be 97.77 %, 25 %, 92.01 % and 50 %. These findings are almost similar to our study.

CONCLUSIONS

On the basis of the present study, we can conclude that breast ultrasound and FNAC both are important diagnostic tools for breast lesions. Sensitivity, specificity and other features were better for FNAC than ultrasound but was comparable. But still ultrasound being non-invasive could be used as an appropriate initial imaging test.

Limitations

As USG is operator-based procedure, its results depend on training of operator, machine quality and its maintenance. Study was done on a single site; a multicentric study should be done to generalise the result.

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