Comparison of Mammography and Ultrasonography in the Diagnosis of Breast Lesions with Fine Needle Aspiration Cytology – A Cross Sectional Study in East Godavari District, Andhra Pradesh

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ABSTRACT

BACKGROUND

Breast cancer is the second most common malignancy and most common among women next to lung cancer. A small lump in the breast leads to great physical, emotional, and psychological trauma to the victim and as well as family. In addition to clinical examination, imaging modalities like mammography (MG), ultrasonography (USG), cytological diagnosis by fine needle aspiration cytology (FNAC) and tissue diagnosis were used for the diagnosis. These diagnostic techniques have certain pitfalls in addition to their advantages. A study was conducted to evaluate the breast lesions according to breast imaging reporting and data system using MG and USG, correlation with FNAC.

METHODS

It was a cross-sectional study, conducted in the Department of Radio-diagnosis, GSL Medical College, Rajahmundry from January 2018 to June 2019, over a period of 18 months. An informed consent was taken from all the participants. The individual with palpable breast lesions detected in clinical examination were included. Physiological swelling, ulcerated and fungal breast growths were not considered. After the detailed clinical history, physical examination, MG and USG were performed, proceeded for FNAC, smears were stained with Leishman and Papanicolaou stain. Statistical analysis was performed by Statistical Package for Social Sciences (SPSS version 20.0). Descriptive data was presented in the form of mean, standard deviation and percentages. Chi-square test was done to assess the association among various categorical data, $P < 0.05$ was considered statistically significant.

RESULTS

Total 142 participants were included, maximum number belong to 41 to 50 years, 0.7 % were male. Right side lesion was the predominant. With FNAC, the sensitivity, specificity and the diagnostic accuracy were 86.5 %, 97.8 % and 93.7 %, respectively for benign breast lesions (BBL) diagnosis and 96.7 %, 84.6 %, 92.25 % respectively for malignant breast lesions (MBL) diagnosis.

CONCLUSIONS

The sensitivity, specificity and diagnostic accuracy was observed to be higher in diagnosis of both BBL and MBL with the combined modalities.

KEYWORDS

Breast Lesions, Benign, Malignant

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DOI: 10.18410/jebmh/2021/622

How to Cite This Article:
Sowmya D, Anusha S, Pidaparti LVSSNP, et al. Comparison of mammography and ultrasonography in the diagnosis of breast lesions with fine needle aspiration cytology – a cross sectional study in East Godavari district, Andhra Pradesh. J Evid Based Med Healthc 2021;8(39):3429-3434. DOI: 10.18410/jebmh/2021/622

Submission 25-08-2021,
Peer Review 31-08-2021,
Acceptance 23-09-2021,
Published 27-09-2021.

BACKGROUND

Breast cancer is the second most common malignancy and most common among women next to lung cancer.[1] A small lump in the breast leads to great physical, emotional, and psychological trauma to the victim and as well as family. Breast evaluation mainly involves the rational use of a detailed history, clinical examination, imaging modalities like mammography (MG), ultrasonography (USG), cytological diagnosis by fine needle aspiration cytology (FNAC) and tissue diagnosis for final diagnosis. These diagnostic techniques have certain pitfalls in addition to their advantages. MG is cost effective, accepted technique for the diagnosis and 30 % deaths rates were minimised.[2] As a screening technique, reduces mortality by 22 % in women aged $\geq$ 50 years and 15 % between 40 to 49 years group.[3] In spite of these advantages, MG is contraindicated.[4]

Among the MG contraindicated patients, high-frequency 7.5 - 13 MHz probes USG is the best imaging process with 100 % sensitivity and negative predictive value.[5] With these, MG and USG are commonly used imaging modalities for the diagnosis of breast lesions and reported highly sensitive results if used in combination.[6] Though, FNAC is used as a widely accepted method for preliminary diagnosis of breast lesions, the characteristic features of the lesions are only visualised by imaging modality such as mammography and ultrasonography. Hence, the diagnosis based on combined features of clinical presentation, imaging features and FNAC findings are considered as more useful. With these, a study was conducted to evaluate the breast lesions according to breast imaging reporting and data system (BIRADS) by using MG, USG, the two radiological, non-invasive methods along with correlation with FNAC findings, an invasive technique.

METHODS

It is a cross-sectional study, conducted in the Department of Radio-diagnosis in collaboration with the Department of Pathology, GSL Medical College, Rajahmundry, East Godavari district, Andhra Pradesh from January 2018 to June 2019, over a period of 18 months. An informed written consent was taken from all the participants and if required, verbal consent in the presence of witness was also taken. The individual with palpable breast lesions which was detected in clinical examination, all age groups, those without any obvious breast mass on palpation but prominent axillary lymph nodes, breast lumps having family history of breast carcinoma and known cases of carcinoma of breast with mastectomy done on one side were included in this study. Individuals with post-traumatic, post-infective, physiological swelling and ulcerated fungal breast growths, very tender breasts were excluded from the study due to difficulty in performing mammography. Non cooperated members for FANC and due to the risk of radiation, pregnant women were also not considered.

Detailed clinical history of date of visit, age of the patient and breast specific information such as menstrual history, details of mastalgia, lactation history, past and family history of any breast problems were also recorded.

MG was performed with GE SENOGRAPHE DMR 60 mA equipment in standing or sitting position in combination with mammographic x-ray tube assembly with compression paddle. The cassette to be used for MG Kodak Min 30 R with single sided screen, ultrasensitive films with emulsion coated on a single side of size 8 x 10". USG will be performed with a 7.5 MHz probe on PHILIPS HD 11 ultrasound machine. Both breasts were evaluated with MG using the film-screen technique. Medio-lateral-oblique and cranio-caudal images were obtained. This was followed by transverse and longitudinal real time imaging of both breasts and axilla by USG. Then proceeded for FNAC.

The skin was disinfected with the surgical spirit. The needle was inserted blindly into the site of lesion. Negative pressure was then applied and the tip of the needle was moved in various directions to collect multiple samples. The negative pressure was released slowly and the needle was withdrawn. Smears were made bedside, minimum of 4 slides comprising of 2 air dried smear and 2 wet smears fixed with 70 % alcohol were prepared. If require, USG guided FANC was also performed. Air dried smears were stained with Leishman stain and wet smears were stained with Papanicolaou stain.[5] Simultaneously, biopsy was also done and the samples were processed as per the standard.[5] Biopsy was considered to calculate the sensitivity, specificity and diagnostic accuracy of MG, USG.

Statistical Analysis

All statistical analysis was performed by SPSS software version 20.0 and MS EXCEL-2007. Descriptive data was presented in the form of mean, standard deviation and percentages. Chi-square test was done to assess the association among various categorical data, $P < 0.05$ was considered statistically significant.

RESULTS

Total 142 participants were included in this study. The age range of these participants was ranged between 16 to 80 years, mean age was 48.59 years; maximum number (44; 30.9 %) of participants belonged to the age group of 41 to 50 years, followed by 31 to 40 years (31; 21.8 %), 51 to 60 years (28; 19.7 %), > 60 years (27; 19.0 %) and 21 to 30 years (9; 6.3 %) age group. There was 1 (0.7 %) male participant who was also included, aged 40 years (Table 1). Among the study members, 48.6 % (69) had lesions on right side of breast, 46.7 % (66) on left side and 4.9 % (7) had bilateral distribution. On clinical assessment, 45.8 % (65) cases were diagnosed to be benign breast lesions, whereas this was 32.4 % (46) with combination of MG and USG. But, FANC proved 36.2 % (52) cases as benign. The malignant cases were 54.2 %, 67.6 % and 63.8 % respectively on clinical assessment, MG and USG and FNAC findings (Table 2). With FANC, 36.2 % cases were diagnosed to be BBL whereas it was 32.4 % with combined effort of USG + MG; the sensitivity (ST), specificity (SP) and the diagnostic accuracy (DA) were 86.5 %, 97.8 % and 93.7 %, respectively (Table 3).

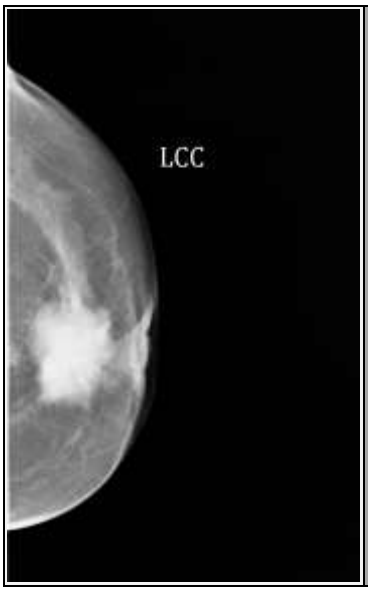

Figure 1. Carcinoma of Breast in Mammogram

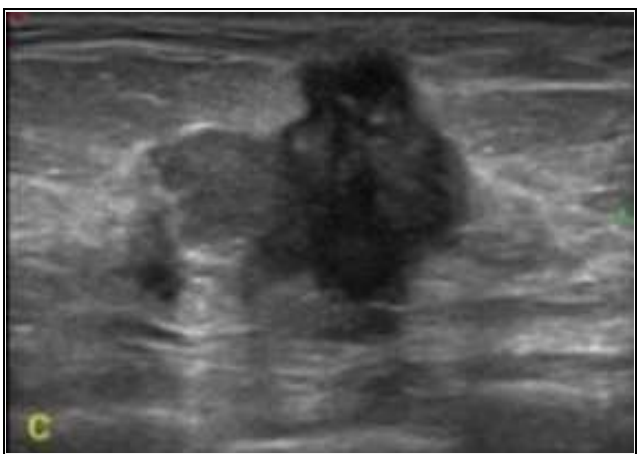

Figure 2. Carcinoma of Breast in Ultrasonogram

Figure 3. FNAC Material

Age	Number	Percentage
< 20	3	2.11
21 – 30	9	6.33
31 – 40	31	21.83
41 – 50	44	30.98
51 – 60	28	19.71
> 60	27	19.01
Total	**142**	**100**

Table 1. Age-Wise Distribution of the Study Participants

Diagnostic Method	Benign	Malignant
Clinical	65 (45.8)	77 (54.2)
MG + USG	46 (32.4)	96 (67.6)
FNAC	52 (36.2)	90 (63.8)

Table 2. Diagnostic Comparison among the Study Members; n (%)

		FNAC		
		Yes	**No**	**Total**
USG + MG	Yes	45 (31.7)	2 (1.8)	47 (32.4)
	No	7 (4.5)	88 (62)	95 (67.6)
	Total	**52 (36.2)**	**90 (63.8)**	**142 (100)**

Table 3. Comparison of USG + MG with FNAC in the Diagnosis of BBL; n (%)

		FNAC		
		Yes	**No**	**Total**
USG + MG	Yes	87 (61.2)	8 (5.6)	95 (67.6)
	No	3 (2.6)	44 (30.8)	47 (32.4)
	Total	**90 (63.8)**	**52 (36.2)**	**142 (100)**

Table 4. Comparison of USG + MG with FNAC in the Diagnosis of MBL; n (%)

In the diagnosis of MBL cases, the DA for USG + MG was 92.25 %. Though, the ST for these combined techniques was 96.7 % but the SP was 84.6 % because 8 false positive. Number wise, FNAC diagnosed 90 cases as MBL whereas it was 95 with USG + MG (Table 4).

DISCUSSION

Among the study participants in this research, the age was ranged between 16 – 80 years; maximum (30.9 %) number of participants were in 41 – 50 years of age group (Table 1), the mean age was 48.59 years. Our observations were similar to Mande et al. report; investigators reported the age range was 19 – 88 years and maximum (32.5 %) number of cases in 41 – 50 years age group.[7] However, Randa et al.[8] observed maximum (49.1 %) cases in 45 – 55 years and 51 % cases were reported by Tiwari et al.[9] in 25 – 35 years group. Whereas similarity of results was reported in male female ratio too, which were reported to be 1 : 0.03 and 1 : 0.02, respectively by Mande et al.[7], Randa et al.[8] and Tiwari et al.[9]

Mande et al.[7] studied on 200 number of participants, the age was ranged between 19 – 88 years; maximum number (32.5 %; 65) was found in 41 – 50 years age group and mean age was 48 years. However, Randa et al.[8] in a similar study on 57 participants stated that age ranged between 29 – 85 years; maximum number (28; 49.1 %) cases were in 45 – 55 years, the mean age was 41 ± 15.30 years. Tiwari et al.[9] reported that majority (46; 50.6 %) of the cases were in 25 – 35 years; the age was ranged between 17 – 56 years and the mean age of the study members was 32 years.

Right side lesions were slightly predominant (48.6 %) in this study, followed by (46.70 %) left side and 7 (4.9 %) cases showed bilateral involvement. However, there is limited availability of the literature to compare this aspect. But, majority of the participants in this study presented with lumps were corroborated with various studies.[5,10,11] In the present study, nipple retraction was observed in 2.8 % (4), peau d'orange appearance in 1.4 % (2) and only axillary

swelling without any breast lesion was observed in 2.1 % (3). Among these, FNAC diagnosed MBL in all the nipple retraction and peau d'orange appearance cases; in the literature, the rate of diagnosis of MBL in peau d'orange appearance was 17 %.[12] Hence, it was observed in this report that nipple retraction and peau d'orange appearance were in favour of malignant lesions.

For breast diseases, quadrant involvement is a specific feature. It was observed to be the most commonly involved site in both benign and malignant lesions as seen in 78 (54.9 %) cases. This finding was similar to study conducted by Randa et al. and Mende et al. who found upper outer quadrant (UOQ) involvement in 109 (54.5 %) cases and 43 (47.3 %) cases respectively.[7,8] This finding was also found in another study conducted by Mohapatra and Satyanarayana at our institute who also showed that UOQ was the commonest site of malignant breast lesion as seen in 116 (65.0 %) cases out of 178 cases. It was also observed that apart from UOQ involvement, malignant lesions were also found in central quadrant of breast, the second most common site of involvement which included retro-areolar and peri-areolar regions in 17 (12.0 %) cases and the diffuse distribution involving all quadrants was seen in 7 (4.9 %) cases. This observation was similar to a study conducted by Tiwari et al. who found UOQ involvement in 24 (48.0 %) cases out of total 50 cases.[9] They also observed central (retro-areolar) quadrants to be the second most common site for malignant lesions seen in 13 (26.0 %) cases out of 50 cases.

Similarly, in a study conducted by Shetty et al. on 411 patients with palpable breast abnormalities, 66 (40 %) cases out of 165 benign cases and 19 (31.6 %) cases out of 60 malignant lesions were occult on mammography and these were identified on ultrasonography.[12]

The remaining 7 out of these 14 false negative cases of the present study were opined as malignant on mammography but turned out to be benign on FNAC findings. The reason behind this misinterpretation in mammography is as follows - One out of these 7 cases (14.3 %) presented with axillary swelling which showed large round radio dense lesion in axilla on mammography, which was interpreted as secondary malignant deposits. It was diagnosed as chronic non-specific lymphadenitis on FNAC findings. Out of the remaining 6 cases, 3 (42.8 %) cases, 2 (28.6 %) cases and 1 (14.3 %) case were opined as fibrocystic disease, benign phyllodes tumour and hematoma respectively on FNAC, and were interpreted as malignant on mammography. The misinterpretations behind similarly, the 16 false positive cases who were opined as benign on mammography but malignant on FNAC could be due to round shape of the lesion as well as presence of the dense breast tissue.

In this study, out of 142 cases, 90 cases were diagnosed as MBL based on FNAC findings. Out of these 90 cases, 73 (81.1 %) cases were opined as malignant on MG findings, hence turned out to be true positive. The rest 17 (18.9 %) cases out of 90 cases were diagnosed as non-malignant lesions i.e. benign on MG and thus, these 17 (18.9 %) cases were categorized as false negative case in comparison to FNAC diagnosis. A total number of 88 cases were opined as malignant on mammography. In 73 out of these 88 cases, the diagnosis matched with FNAC findings and in the rest 15 cases the diagnosis was non concordant with FNAC findings and thus categorised as false negative. Thus, comparing mammography with FNAC in the diagnosis of malignant breast lesions, sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were found to be 81.1 %, 71.15 %, 82.95 %, 68.5 % and 77.46 % respectively (Fig. 6). We could not compare these findings with others as there is no availability of documentation on this aspect.

Calcification is a salient finding to distinguish benign and MBL using MG. In this study, all the breast lesions with pleomorphic type of calcification on MG were diagnosed to be malignant with FNAC. However, 81 (57.0 %) cases which did not show any type of calcifications were also found to be malignant; this is similar to study conducted by of Wendie et al.[13] Hence, pleomorphic type of calcification can be considered as one of the diagnostic criteria for MBL on MG. Therefore, the characteristic features of benign lesions on MG include oval shape, well circumscribed margins and that of malignant lesions are characterised by speculated margins and pleomorphic calcifications.

All well-defined lesions seen in 52 (36.6 %) cases on MG were found to be benign on cytology findings. All the lesions with speculated margins seen in 41 (28.9 %) cases and majority of the lesions with micro lobulations seen in 17 (11.9 %) cases seen on MG, were found to be positive for malignancy based on FNAC findings. Hence, it was seen that well circumscribed breast lesions were in favour of benign lesions and all the lesions with speculated margins were in favour of malignant lesions. In this study, all the breast lesions with pleomorphic type of calcification as seen in 38 (26.8 %) cases on mammography were found to be positive for malignancy on FNAC. However, we observed that 81 (57.0 %) cases which did not show any type of calcifications were also found to be having malignant lesions on FNAC.

In this report, 46 (32.4 %) were diagnosed to be BBL and 96 (67.6 %) as MBL. Fibroadenoma was the most common cause for BBL (17; 36.9 %). This finding was similar to observations made by Mande et al.[7], Kaufman et al.[14] and Ahmed et al.[15] Ductal adeno-carcinoma was the most common cytological diagnosis among the MBL in this study which is similar to the study reported by Mohapatra et al.[16]

FNAC identified 36.6 % (52) cases as BBL; among these, 86.5 % were TP, diagnosed to be the same based on combined MG and USG findings. Among the FN cases, 2 (28.6 %) were large heterogenous lesions on USG and MG opined as malignant lesions which were turned out to be benign phyllodes tumour on FNAC findings; and 4 (57.1 %) cases diagnosed as suspicious lesions due to complex cystic lesions with heterogenous collections and internal echogenic areas on USG and large lobulated radio-dense lesions on MG were turned out to be benign FNAC. Further, 1 (14.3 %) was diagnosed as metastatic axillary deposit due to round shape and loss of hilum on ultrasonography and large round radio-dense lesion on MG which was diagnosed as chronic non-specific lymphadenitis on FNAC findings.

In addition to shape and margins of lesions as described on MG, echo-pattern and diameter of breast lesions on USG

showed some definitive characteristic features in benign and malignant lesions.

All the lesions with longitudinal diameter versus antero-posterior diameter ratio of > 1 seen in 38 (26.8 %) cases were diagnosed as benign on FNAC findings. The rest of the lesions i.e. 104 (73.2 %) with longitudinal diameter versus antero-posterior diameter ratio of < 1 on USG were diagnosed as either benign or malignant in comparison to FNAC findings. All the heterogeneous lesions with predominantly hypo-echogenicity as seen in 86 (60.6 %) cases on USG were proved to be malignant on FNAC findings whereas all the anechoic lesions seen in 24 (16.9 %) cases and hyper-echoic lesions seen in 10 (7.0 %) cases were proved to be benign on FNAC diagnosis. Hence, we observed that lesions with longitudinal diameter versus antero-posterior diameter ratio of > 1 and anechoic or hyper-echoic breast lesions were suggestive of benign lesions.

These findings were similar to the study conducted by Luciano et al. on characteristic features of benign breast lesions based on ultrasonography who observed that rounded lesions with well-circumscribed margins, longitudinal versus antero-posterior diameter ratio of > 1 and lesions without hypo-echogenicity or obvious micro-calcifications are suggestive of BBL. The authors also reported that high sensitivity and specificity of the USG. And the higher accuracy rate of USG diagnosis was its ability to detect the hidden lesions in dense breasts as well as to characterize the lesions which mammography failed to detect.

Among the 47 (33.8 %) cases which were diagnosed to be BBL based on combined USG and MG findings, 95.7 % (45) were TP and the rest were diagnosed as malignant lesions based on FNAC, hence these were categorized to be FP, diagnosed to be abscess and ductal papilloma, respectively by USG and MG.

Among the MBL, 96.7 % (87) were the TP and 3 (3.3 %) were FN as these were diagnosed to be BBL on both MG and USG findings. The sensitivity and specificity for the combined MG and USG were increased in the diagnosis of breast lesions. This is in similar to a study conducted by Mulhim et al. where out of total 140 cases, 116 cases were concordant and 24 non-concordant cases.[17] Similar findings were reported by Strasser et al.[18] Zonderland et al.[19] Phurailatpam et al.[20] and Taori et al.[21] This is in contrast to a study by Ahmed et al. where 19 cases out of 35 cases were concordant and 16 cases were non-concordant.[15]

CONCLUSIONS

The sensitivity, specificity and diagnostic accuracy was observed to be higher in diagnosis of both BBL and MBL when the combined imaging modality features namely MG and USG were taken into account.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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