COMPARATIVE STUDY OF DIAGNOSTIC EFFICACY OF FNAC, HR-USG & MAMMOGRAPHY IN PALPABLE BREAST LUMP

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ABSTRACT

BACKGROUND

With growing awareness and increasing literacy, people have now become more conscious about problems related to breast. The commonest mode of presentation of diseases of the breast is "lump" or a "palpable mass". It may not necessarily be a malignant lesion, instead palpable breast masses are common and are usually benign, but efficient evaluation and prompt diagnosis are necessary to rule out malignancy. The present study was planned with an aim to evaluate the efficacy of HR-USG, Mammography and FNAC, either individually or in combination for the diagnosis of palpable breast lumps.

MATERIALS AND METHODS

The descriptive study was carried out at Department of Surgery, Era's Lucknow Medical College, Lucknow. Duration of study was 18 months starting from January 2017 to June 2018. A total of 65 patients were enrolled in the study who underwent HR-USG, FNAC, Mammography and Histopathological examination.

RESULTS

In present study, majority of cases were histopathologically confirmed as benign (69.2%). Among benign cases, maximum (n=37; 56.9%) were diagnosed as fibroadenoma, 4 (6.2%) were diagnosed as simple benign lesion and 3 (4.6%) were diagnosed as chronic inflammatory lesion. There were 21 (30.8%) malignant cases, for malignancy, FNAC had a sensitivity and specificity of 90% and 100% as compared to 76.2% and 100% for mammography and 71.4% and 97.7% for USG.

CONCLUSION

The findings of the present study suggest that among three diagnostic modalities being evaluated, FNAC was the best, but one of the limitations of FNAC was inconclusive findings in few cases. However, complementary use of USG for these cases which were inconclusive on FNAC helped to achieve the best diagnostic combination for evaluation of palpable lump.

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BACKGROUND

With growing awareness and increasing literacy, people have now become more conscious towards problems related with breast. The commonest mode of presentation of diseases of the breast is "lump" or a "palpable mass." It may not necessarily be a malignant lesion, instead palpable breast masses are common and usually benign, but efficient evaluation and prompt diagnosis are necessary to rule out malignancy. In order to provide the patient an optimal treatment, it is essential to carry out an accurate preoperative diagnosis.

A single-modality test is not accurate enough to make the correct diagnosis for a breast lesion. However, the accuracy of the diagnosis can be increased by employing multimodality tests. A number of modalities together are more accurate and reliable compared to a single-modality test, despite having their own technical limitations.

However, in recent years, ultrasonography has emerged as an effective diagnostic tool in evaluation of palpable solid breast masses. The diagnostic accuracy of mammography and USG has been seen to be increased when used in combination.¹

Fine-needle aspiration is fast, inexpensive, and accurate, and it can differentiate solid and cystic masses.

Thus, all the three diagnostic tests have their usefulness in evaluation of palpable breast lesions, however, it is often queried that in view of emerging improvements in technology, particularly with the emergence of digital mammography, improved methods of FNAC and high-resolution USG, whether the number of these tests could be reduced, or the combination of these tests could be altered. Hence, the present study was planned with an aim to evaluate the efficacy of HR-USG, Mammography and FNAC, either

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individual or in combination for diagnosis of Palpable breast lumps.

MATERIALS AND METHODS

The aim of this study was to compare the diagnostic efficacy of HR-USG, FNAC and mammography in early diagnosis of patients presenting with palpable breast lump to outpatient department of General Surgery, Era's Lucknow Medical College & Hospital, Lucknow.

The study was designed as descriptive study to be conducted over a period of 18 months.

After obtaining an informed consent, demographic information and details regarding breast complaints, like lump, nipple discharge or retraction were noted.

All participants were subjected to clinical examination, HR-USG, Mammography, FNAC and histopathological reporting according to study protocol.

Sample Size Calculation

RESULTS

A total of 65 women with palpable breast lumps were enrolled in the study.

Lump Characteristics

Figure 1. Lump Characteristics

Right side (50.8%) was slightly more commonly involved than the left side (49.2%). Maximum had lump with a size of 2 cm (38.5%) followed by 3 cm (29.2%), 4 cm (18.5%) and 5 cm (13.8%) respectively. Majority (81.5%) had smooth surface while 12 (18.5%) had irregular surface of lump. Except for 3 (4.6%), all the other cases had well defined lump margins. All the lumps had firm consistency. None of the cases showed lump fluctuation or transillumination. In majority lump was not fixed to skin (89.2%) or breast (93.8%). None of the cases showed fixity to deeper structure or axilla and supraclavicular fossa involvement.

Histopathological Examination

Figure 2. Histopathological Diagnosis

Sample size is calculated on the basis of sensitivity & ppv of mammography (Having minimum sensitivity among the three tests) using the formula-

$$n = \frac{z_{\alpha}^2 S_n (1 - S_n)}{pe^2}$$

Where

$S_n = 0.846$, the sensitivity of mammography

$p = 0.846$, the PPV of mammography

Type I error = 5 %

Allowable error $e = 0.1$ absolute for detecting results with 90% power of study.

Data loss = 10 %.

Then sample size comes out to be $n = 65$

Histopathologically, majority (n=44; 69.2%) were diagnosed as non-malignant. However, 21 (30.8%) were diagnosed as malignant. Among non-malignant lumps, maximum (n=37; 56.9%) were diagnosed as fibroadenoma, 4 (6.2%) were diagnosed as simple benign lesion and 3 (4.6%) were diagnosed as chronic inflammatory lesion.

Mammography

Figure 3. Mammographic Diagnosis

On mammography, majority (n=49; 75.4%) were diagnosed as non-malignant. However, 16 (24.6%) were diagnosed as malignant. Among non-malignant lumps, maximum (n=34; 52.3%) were diagnosed as fibroadenoma, 2 (3.1%) were diagnosed as simple benign lesion and 1 (1.5%) was diagnosed as inflammatory lesion. There were 12 (18.5%) cases diagnosed normal on mammography.

High Resolution-Ultrasonography

Figure 4. HR-USG Diagnosis

On HR-USG, majority (n=49; 75.4%) were diagnosed as non-malignant. However, 16 (24.6%) were diagnosed as malignant. Among non-malignant lumps, maximum (n=38; 58.5%) were diagnosed as fibroadenoma, 2 (3.1%) each were diagnosed as simple benign lesion and inflammatory lesion respectively while 7 (10.8%) cases were diagnosed as normal on USG.

Fine Needle Aspiration Cytology

Figure 5. FNAC Diagnosis (n=65)

On FNAC, majority (n=44; 67.7%) were diagnosed as non-malignant. However, 18 (27.7%) were diagnosed as malignant. Among non-malignant lumps, maximum (n=36; 55.4%) were diagnosed as fibroadenoma, 4 (6.2%) were diagnosed as simple benign lesion and 3 (4.6%) as inflammatory lesion. There was 1 (1.5%) case diagnosed as normal. FNAC was inconclusive in 3 (4.6%) cases.

Mammography		Histopathology		Total	
		Malignant	Non-Malignant		
Malignant		16	0	16	
Non-Malignant		5	44	49	
Total		21	44	65	
Sensitivity	Specificity	PPV	NPV	Accuracy	
76.2%	100%	100%	89.8%	92.3%	
Table 1. Evaluation of Diagnostic Efficacy of Different Diagnostic Methods for Detection of Breast Carcinoma (Malignant Lumps) (n=21)					
Mammography (n=65)					

Ultrasonography		Histopathology		Total	
		Malignant	Non-Malignant		
Malignant		15	1	16	
Non-Malignant		6	43	49	
Total		21	44	65	
Sensitivity	Specificity	PPV	NPV	Accuracy	
71.4%	97.7%	93.8%	87.8%	89.2%	
Ultrasonography (n=65)					

FNAC		Histopathology		Total	
		Malignant	Non-Malignant		
Malignant		18	0	18	
Non-Malignant		2	42	44	
Total		20	42	62	
Sensitivity	Specificity	PPV	NPV	Accuracy	
90.0%	100%	100%	95.5%	96.8%	
(c) FNAC (n=62)

Figure 6. Evaluation of Diagnostic Efficacy of Different Diagnostic Methods for Detection of Breast Carcinoma (Malignant Lumps)

On evaluating the diagnostic efficacy of mammography, ultrasonography and FNAC for detection of malignancy, sensitivity and specificity of FNAC was maximum (90% and 100%). Between mammography and USG, mammography was more sensitive as well as specific (76.2% and 100%) as compared to USG (71.4% and 97.7%). Both mammography and FNAC had 100% positive predictive value as compared to 93.8% for USG. With respect to negative predictive value, FNAC had maximum value (95.5%) followed by Mammography (89.8%) and USG (87.8%) respectively. Overall accuracy for detection of malignancy was also maximum for FNAC (96.8%) followed by mammography (92.3%) and USG (89.2%) respectively.

Mammography		Histopathology		Total
		Fibroadenoma	Others	
Fibroadenoma		31	3	34
Others		5	26	31
Total		36	29	65
Sensitivity	Specificity	PPV	NPV	Accuracy
86.1%	89.7%	91.2%	83.9%	87.7%
Table 2. Evaluation of Diagnostic Efficacy of Different Diagnostic Methods for Detection of Fibroadenoma (n=36)				
Mammography (n=65)				

USG		Histopathology		Total	
		Fibroadenoma	Others		
Fibroadenoma		32	6	38	
Others		4	23	27	
Total		36	29	65	
Sensitivity	Specificity	PPV	NPV	Accuracy	
88.9%	79.3%	84.2%	85.2%	84.6%	
(b) USG (n=65)					

USG		Histopathology		Total
		Fibroadenoma	Others	
Fibroadenoma		34	2	36
Others		2	24	26
Total		36	26	62
Sensitivity	Specificity	PPV	NPV	Accuracy
94.4%	92.3%	94.4%	92.3%	93.5%
(c) FNAC (n=62)

On evaluating the diagnostic efficacy of mammography, ultrasonography and FNAC for detection of fibroadenoma, sensitivity and specificity of FNAC was maximum (94.4% and 92.3%). Between mammography and USG, USG was more sensitive (88.9%) as compared to mammography (86.1%) while mammography was more specific (89.7%) as compared to USG (79.3%). FNAC also had maximum PPV and NPV (94.4% and 92.3%). Between mammography and USG, mammography had higher PPV (91.2%) as compared to USG (84.2%) whereas USG had higher NPV (85.2%) as compared to mammography (83.9%). Overall accuracy for detection of fibroadenoma was maximum for FNAC (93.5%) followed by mammography (87.7%) and USG (84.6%) respectively.

Mammography		Histopathology		Total	
		Simple Benign lesion	Others		
Simple Benign lesion		2	0	2	
Others		2	61	63	
Total		4	61	65	
Sensitivity		Specificity	PPV	NPV	Accuracy
50%		100%	100%	95.3%	96.9%
Table 3. Evaluation of Diagnostic Efficacy of Different Diagnostic Methods for Detection of Simple Benign Lesions (n=4)					
Mammography (n=65)					

USG		Histopathology		Total	
		Simple Benign Lesion	Others		
Simple Benign lesion		2	0	2	
Others		2	61	63	
Total		4	61	65	
Sensitivity	Specificity	PPV	NPV	Accuracy	
50%	100%	100%	95.3%	96.9%	
(b) USG (n=65)					

USG		Histopathology		Total	
		Simple Benign lesion	Others		
Simple Benign lesion		4	0	4	
Others		0	58	58	
Total		4	58	62	
Sensitivity	Specificity	PPV	NPV	Accuracy	
100%	100%	100%	100%	100%	
(c) FNAC (n=62)

Figure 8. Evaluation of Diagnostic Efficacy of Different Diagnostic Methods for Detection of Simple Benign Lesion

On evaluating the diagnostic efficacy of mammography, ultrasonography and FNAC for detection of simple benign lesion, FNAC showed 100% accuracy. Both USG and mammography same showed sensitivity, specificity, PPV, NPV and accuracy, i.e. 50%, 100%, 100%, 95.3% and 96.9% respectively.

Mammography		Histopathology		Total
		Inflammatory lesion	Others	
Inflammatory Lesion		1	0	1
Others		2	62	64
Total		3	62	65
Sensitivity	Specificity	PPV	NPV	Accuracy
33.3%	100%	100%	96.9%	96.9%
Table 4. Evaluation of Diagnostic Efficacy of Different Diagnostic Methods for Detection of Inflammatory Lesions (n=3)				
Mammography (n=65)				

USG		Histopathology		Total
		Inflammatory lesion	Others	
Inflammatory Lesion		2	0	2
Others		1	62	63
Total		3	62	65
Sensitivity	Specificity	PPV	NPV	Accuracy
66.7%	100%	100%	98.4%	98.5%
(b) USG (n=65)				

USG	Histopathology			Total
	Inflammatory Lesion	Others		
Inflammatory Lesion	3	0		3
Others	0	59		59
Total	3	59		62
Sensitivity	Specificity	PPV	NPV	Accuracy
100%	100%	100%	100%	100%
(c) FNAC (n=62)

Figure 9. Evaluation of Diagnostic Efficacy of Different Diagnostic Methods for Detection of Inflammatory Lesions

On evaluating the diagnostic efficacy of mammography, ultrasonography and FNAC for detection of inflammatory lesions, FNAC showed 100% accuracy. Between USG and mammography, both were 100% specific, however, USG was more sensitive (66.7%) as compared to mammography (33.3%). In terms of accuracy FNAC was best (100%) followed by USG (98.5%) and mammography (96.9%) respectively.

DISCUSSION

In present study, majority of cases were histopathologically confirmed as benign (69.2%). Among benign cases, maximum (n=37; 56.9%) were diagnosed as fibroadenoma, 4 (6.2%) were diagnosed as simple benign lesion and 3 (4.6%) were diagnosed as chronic inflammatory lesion. There were 21 (30.8%) malignant cases. Similar to findings of present study, previous studies too have reported a dominance of benign conditions and malignancy to be a dormant finding. In study of Rahman et al.² and Khoda et al.¹ the malignancy rate was 28.6% and 24%. Taori et al.³ and Khan et al.⁴ reported malignancy rate of 18.1% and 18.7% respectively. Nigam and Nigam⁵ found malignancy in only 10% cases. The findings of

present study were comparable to the findings of Takhellambam et al.⁶ and Harini et al.⁷ Who reported a malignancy rate of 35.5% and 30.3% cases respectively which is close to the observations made in present study. As for dominance of fibroadenoma in benign cases, it is probably the most common benign breast condition encountered in different studies.^{8,9,10,11,12,13} In their study, Tiwari et al. in their final diagnosis found 17% cases as carcinoma, 41.5% fibrocystic disease, 28.3% fibroadenoma, 5.7% cysts, 3.7% infection and 1.9% lipoma.

In present study, on mammography, majority (n=49; 75.4%) were diagnosed as non-malignant. However, 16 (24.6%) were diagnosed as malignant. Among non-malignant lumps, maximum (n=34; 52.3%) were diagnosed as fibroadenoma, 2 (3.1%) were diagnosed as simple benign lesion and 1 (1.5%) was diagnosed as inflammatory lesion. There were 12 (18.5%) cases diagnosed normal on mammography. In their study, Tiwari et al.¹⁴ on mammography found malignancy in 15.1%, fibrocystic disease in 34%, fibroadenoma in 22.6%, cyst in 3.7%, and infection and lipoma in 1.9% case each. Thus, similar to present study, they also found malignancy rate to be lower in

mammography as compared to final diagnosis. Chaudhari et al.¹⁵ too in their study found detection of malignancy to be lower in mammography (46%) as compared to histopathology (62%). Similar observations were also made by other workers too.^{2,3,5,14}

In present study, on USG, majority (n=49; 75.4%) were diagnosed as non-malignant. However,¹⁵ (24.6%) were diagnosed as malignant. Among non-malignant lumps, maximum (n=38; 58.5%) were diagnosed as fibroadenoma, 2 (3.1%) each were diagnosed as simple benign lesion and inflammatory lesion respectively while 7 (10.8%) cases were diagnosed as normal on USG. Thus, similar to mammography, USG also underestimated malignancy while overestimated the fibroadenoma cases slightly. However, Tiwari et al. in their study found malignancy detection rate to be lower in USG as compared to mammography as well as final diagnosis. Chaudhari et al.¹⁵ similar to our finding reported the malignancy detection rate in USG to be lower as compared to final diagnosis. Although, they overestimated the benign conditions in general but did not describe the profile of benign conditions separately and hence we are not in a position to comment whether they particularly overestimated fibroadenoma.

In present study, on FNAC, majority (n=44; 67.7%) were diagnosed as non-malignant. However, 18 (27.7%) were diagnosed as malignant. Among non-malignant lumps, maximum (n=36; 55.4%) were diagnosed as fibroadenoma, 4 (6.2%) were diagnosed as simple benign lesion and 3 (4.6%) as inflammatory lesion. There was 1 (1.5%) case diagnosed as normal. FNAC was inconclusive in 3 (4.6%) cases. Thus, compared to mammography and USG, the detection rate for malignancy was higher in FNAC whereas for fibroadenoma it underestimated but did not underestimate to the extent of mammography. In most of the studies reviewed by us, detection rate of malignancy has been reported to be high and close to final diagnosis.^{2,6,5} However, Khoda et al.¹ found both USG and FNAC to be comparable in detection of malignancy.

In present study, for malignancy, FNAC had a sensitivity and specificity of 90% and 100% as compared to 76.2% and 100% for mammography and 71.4% and 97.7% for USG, thus among the three FNAC was the best followed by mammography while USG was least sensitive and specific. The superiority of FNAC over USG and mammography has been endorsed by several workers for evaluation of malignancy. Rahman et al.² in their study reported sensitivity and specificity of FNAC to be 97.22% and 99.46% as compared to 82.76% and 90.36% for mammography. Nigam and Nigam⁶ in their study reported USG to be 66.7% sensitive and 100% specific as compared to FNAC which was 73.3% sensitive and 100% specific. However, Khoda et al.¹ in their study found both USG and FNAC to hold equal sensitivity and specificity (91.6% and 100%). In present study, mammography had slight edge over USG in terms of increased sensitivity, however, Kumar et al.¹⁶ in their study found USG to have better sensitivity and specificity (92.3% and 97.29%) as compared to mammography (84.61% and 94.59%). But Tiwari et al.¹⁷ similar to our study found mammography to be more sensitive and specific as compared to USG in detection of malignancy.

In present study, for different benign conditions, between mammography and USG, USG was more sensitive than mammography whereas mammography was more specific than USG for fibroadenoma. For simple benign lesions, both USG and mammography were 50% sensitive and 100% specific, however for inflammatory lesions, USG had better sensitivity and specificity (66.7% and 100%) as compared to mammography (33.3% and 100%). However, in their study, Prasad and Houserikova found that mammography had an efficiency of 81.8 % as compared to 95.5 % for USG in detecting fibrocystic mastitis while for fibroadenoma, mammography was more efficient (75%) as compared to USG (35%), thus showing that the findings matched for inflammatory conditions only.

One of the limitations of FNAC was inadequacy in three cases owing to which the diagnosis was inconclusive. On histopathology, the diagnosis was carcinoma in one case and fibroadenoma in remaining two cases, these cases were thus missed by FNAC and resulted in loss of diagnosis. However, USG findings in these three cases were consistent with the histopathology, thus showing that combination of USG and FNAC could help in achieving a better diagnosis. Although combination of mammography and USG or all the three techniques to improve diagnostic performance has been reported by several studies previously,^{18,3,5} however, similar to our observation, some other workers^{19,20} have found combination of USG and FNAC to be highly efficient and effective. We feel that combination of one imaging modality (USG) and one cytological assessment (FNAC) could provide the information regarding the morphology as well as cytology and hence can provide a better diagnosis. Moreover, USG can help in compensating the loss of diagnosis in cases where FNAC is inadequate and hence results are inconclusive. In view of the findings of present study, we recommend the use of FNAC in combination with USG for evaluation of breast masses. However, keeping in view the diverse profile of benign and malignant pathologies of breast, it is recommended that further studies on larger sample size must be carried out to confirm and validate the findings of present study.

CONCLUSION

The present study assessed the usefulness of mammography, ultrasonography and fine needle aspiration cytology in evaluation of palpable breast lump. For this purpose, a total of 65 women with palpable breast lumps were enrolled in the study and were evaluated using the three diagnostic modalities. The outcome was compared against histopathology.

The findings of present study suggested that among three diagnostic modalities being evaluated, FNAC was the best but one of the limitations of FNAC was inconclusive findings in few cases. However, complementary use of USG for these cases inconclusive on FNAC helped to achieve the best diagnostic combination for evaluation of palpable lump. The present study was limited by the sample size; hence, diagnostic values for simple benign lesions and inflammatory lesions which had only a limited representation could be exaggerated and be dependent on incidental findings; hence, further studies on larger sample size are recommended to corroborate the findings of the present study.

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