

Accuracy of Breast Ultrasonography In Predicting The Diagnosis of Breast Lump

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Introduction

One-fourth of women suffer from breast disease in their lifetime. Most of these are non-proliferative benign breast diseases (BBD). Carcinoma of the breast (BC) is the second most common cancer in the world, breast lumps are always a source of great anxiety among females of any age. This anxiety is more than mere cancer-phobia because certain benign breast diseases in themselves are important risk factors for breast cancer.¹⁻³ In developed countries, BC is the most common malignancy diagnosed in women, and in developing countries, it ranks second only to cervical cancer.⁴⁻⁶ In the study done on the Nepalese population at the community level, the prevalence of breast lumps among 15 to 49 years old females was found to be 3.9%, which is much lower than in other developing Asia countries.^{7,8}

Most common BBDs are fibroadenoma, fibrocystic disease, breast abscess, duct ectasia, granulomatous disease and fat necrosis while malignant conditions comprise ductal carcinoma in situ (DCIS), invasive ductal carcinoma (IDC), invasive lobular carcinoma (ILC) and medullary carcinoma (MC).⁹ Women

affected by illnesses such as breast cancer suffer from social stigma and psychological trauma as an additional insult. Many women have long-standing breast lumps and do not see a doctor until the disease progresses to a grave condition.⁴

Referred to as the triple assessment (TA), a combination of clinical examination, radiological imaging (mammography, ultrasonography), and histopathology are used as the Gold standard in diagnosing all palpable breasts. It has a sensitivity of 99% and an overall accuracy of 99.3% in the detection of patients with breast cancer.¹⁰ Earlier, USG (Ultrasonography) was predominantly employed to differentiate cystic from solid breast masses. Its role now has expanded from simply characterizing the internal contents of the mass to differentiating between benign and malignant solid masses.^{11,12,13} FNAC (Fine Needle Aspiration Cytology) and core needle biopsy (CNB) are useful methods of pathological diagnosis.¹⁴ All breast lesions are not malignant, and all benign lesions do not progress to cancer.¹⁵

Histopathological tissue diagnosis is naturally the most accurate test for diagnosing any breast lump, but it is not always available in rural settings of underdeveloped countries like Nepal. Ultrasound scanners, on the other hand, have already

Abstract

Introduction: A palpable lump in a woman's breast could be benign or malignant, and it requires prompt evaluation to confirm or exclude cancer. This study was done to assess the accuracy of ultrasonography in diagnosing breast lumps.

Methods: Cross-sectional study over 6 months. Demographic data along with the site and size of breast lumps, relevant history and clinical information were collected to determine the nature (malignant/nonmalignant) of breast lumps. Points relevant to the predictive values of the sonograms were obtained. The data were entered into Microsoft Excel, and statistical analysis was performed using SPSS, RStudio, and MedCalc.

Results: The diagnostic accuracy of ultrasonography in relation to histopathological diagnosis was 85%. The sensitivity and specificity of ultrasonography were found to be 80%, 86%. The positive and negative predictive values of the ultrasonography were 53.33% and 95.55%.

Conclusions: Whenever feasible, pathological correlation should be performed in all cases of breast lumps.

Keywords: Breast Ultrasonography, Breast Lump, Palpable lump, Breast disease

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been made available in most rural healthcare centers. The usual practice now is to refer any patient with a breast lump for histopathological diagnosis, which takes a lot of unnecessary tolls on the patient and her family in terms of financial burden, waste of time, and mental stress. If the nature of the lump is evaluated using a mere combination of clinical examination and radiological investigation before referring the patient to 'higher' centers, the patients with benign lumps can be kept safely in close observation, and biopsy can be deferred for the time being. This will be beneficial to patients economically and socially, and only suspicious malignant lesions can be referred to a better center for tissue diagnosis.

Methods

This cross-sectional study was conducted at Bir Hospital and Kathmandu Model Hospital after an approval letter was taken from the Institutional Review Board, NAMS (National Academy of Medical Sciences). Written/Verbal informed consent was obtained from all the patients before they were enrolled in the study. USG was done by consultant radiologists with SIUI Apogee 5300 USG machine using linear probe. Sixty (Prevalence of breast lump = $4\%^7 = 0.04$) female patients of age 15-59 years who present on surgical OPD with a breast lump and undergone USG breast and Fine Needle Aspiration Biopsy/Core Needle Biopsy/ Excisional Biopsy in Bir Hospital and Kathmandu Model Hospital from September 2022 to March 2023 were included in the study. Patients presenting with bilateral breast lumps were considered as two samples. Data collection was done by filling out the proforma containing the demographic details of the patient. Relevant details of radiological investigation (USG) and pathology investigation (FNA/CNB/EB). Data were entered into Microsoft Excel and were analyzed using RStudio, SPSS and MedCalc. The Chi-square test and Fisher exact test were used to test for group differences wherever applicable.

Results

A total of 60 patients with breast lumps were included in the study. Age distribution of patients is shown in table 1. The mean age was 34.80 ± 9.08 (17-49) years.

Table 1: Age distribution of patients with breast lumps.

Age	Number	Percentage(%)
15-19	4	6.6
20-24	6	10
25-29	8	13.33
30-34	8	13.33
35-39	12	20
40-44	14	23.33
45-49	8	13.33

Table 2: Ultrasonography findings.

	Category	No	Percentage(%)
USG site	Lower inner quadrant	2	3.33
	Lower outer quadrant	10	16.66
	Upper inner quadrant	11	18.33
	Upper outer quadrant	33	55.00
	Retro areolar	4	6.66
Size(cm)	<2	3	5
	2-5	46	76.66
	>5	11	18.33
Echogenicity	Hypo	39	65.0
	Iso	3	5.0
	Mixed	18	30.0
Calcification	Absent	51	85.00
	Present	9	15.00
Vascularity	Absent	38	63.33
	Present	15	25.00
	Not mentioned	7	11.66
Inference from USG	Likely benign	45	75.00
	Likely malignant	15	25.00

Table 3: Results of the pathological examination of breast lumps.

Histopathology	Category	No	Percentage(%)
Diagnosis	Breast abscess	7	11.6
	Carcinoma	10	16.6
	Duct ectasia	2	3.3
	Fibroadenoma	28	46.6
	Fibrocystic disease	5	8.3
	Fat necrosis	1	1.6
	Galactocele	2	3.3
	Simple breast cyst	3	5
	Tubercular breast abscess	2	3.3
Malignancy	Malignant	10	16.66
	Nonmalignant	50	83.33

On pathological diagnosis, 17 % of cases were diagnosed as malignant and 83 % as nonmalignant. Fibroadenoma was most common among nonmalignant diseases.

Table 4: Association of ultrasonography features with benign and malignant lumps.

Ultrasonography		Histology diagnosis		P-value
Features	Category	Non-malignant	Malignant	
Site	Lower inner quadrant	2	0	0.50
	Lower outer quadrant	7	3	
	Upper inner quadrant	11	0	
	Upper outer quadrant	26	7	
	Retroareolar	4	0	
Echogenicity	Hypo	37	2	<0.001
	Iso	0	3	
	Mixed	13	5	
Calcification	Absent	43	8	0.85
	Present	7	2	
Vascularity	Absent	36	2	<0.01 (excluding not mentioned samples)
	Present	9	6	
	Not mentioned	5	2	

Malignant lumps were predominantly present in the outer quadrant of the breast, whereas nonmalignant lumps were predominantly present in the upper quadrant of the breast. Most of the benign lumps were hypoechoic in USG, whereas mixed echogenicity was found in most of the malignant lumps. Calcification was mostly present in malignant lumps. Malignant lumps were more vascular than nonmalignant lumps.

Table 5: Accuracy of USG with Histopathological findings.

Ultrasonography	Histopathological Findings		Total
	Malignant	Nonmalignant	
Malignant	8	7	15
Nonmalignant	2	43	45
Total	10	50	60

Table 6: Accuracy, Sensitivity, Specificity PPV and NPV of USG with HPE.

Parameter	Value (%)	95% CI
Accuracy	85.00	[73.43,92.90]
Sensitivity	80.00	[44.39, 97.48]
Specificity	86.00	[73.26, 94.18]
Positive predictive value(PPV)	53.33	[34.9,70.83]
Negative Predictive value(NPV)	95.55	[86.10,98.68]

Discussion

A lump is the first symptom in over 80 percent of all patients with cancer of the breast. Consequently, the finding of any lump in the breast is a highly significant sign and warrants a thorough investigation.¹⁶The mean age of patients presenting with breast lumps was 34.80± 9.08 years (17-49). In a similar study done by Bistoni et al., the mean age of females presenting with breast lumps was 41 years¹⁵. Breast lumps were most common in the age group between 40 to 44. Similarly, in the study by Shoeb et al., in 50 cancer patients above 18 years of age, the maximum number of participants (36%) were in the age group of 41-50

years.⁴ In the study by Laul et al., benign breast lumps were found more commonly in the 18-30 years of age group, whereas malignant breast lumps were seen more commonly in the 41-60 years age group and the incidence increased with age.¹⁷. Seemingly early age of having cancer in our study subjects could be due to the inclusion of the younger patients. However, further studies with a much larger sample size are needed in order to rule out the possibility of early cancer in the Nepali population.

Out of 60 lumps in our study, 10(16.66%) were diagnosed to be malignant and 50(80.33%) were diagnosed to be benign. This almost equals the study by Gurav et al. where out of 50 studied cases,35 (70%) patients had benign and 15 (30%) had malignant lesions.¹⁸. In our study, out of 50 benign cases, 28(56%) were fibroadenoma, and 5(10%) were fibrocystic diseases also similar to the study by Gurav et al. where out of 35 benign lesions, the commonest lesion was found to be fibroadenoma (52%) and fibrocystic disease (10%).¹⁸ In our study, the diagnostic spectrum of benign lumps in decreasing order are fibroadenomas, breast abscess, simple breast cyst, tubercular breast abscess, galactoceles, duct ectasia, and traumatic fat necrosis. The prevalence of breast abscesses was found high in our study compared to studies done in developed countries. In another study, the most frequent clinical symptom was noticing a lump in the breast and mostly fibroadenoma (53.4%).¹⁹

The overall most common site of the location of the lump was the upper outer quadrant (55%), followed by the upper inner (18.33%), lower outer (16.66%), retroareolar (6.66%) and lower inner quadrant (3.33%). Malignant lumps were mostly found in the upper outer quadrant (70%) and lower outer quadrant(30%). Nonmalignant lumps are also found more commonly in the upper outer quadrant(52%), followed by the upper inner quadrant (22%), lower outer quadrant(14%), retroareolar(8%), and lower inner quadrant (2%). Similar results were found in the study by Gurav et al., which shows that the most common site of lesion was found to be the upper outer quadrant (48%), followed by the upper inner quadrant (18%), lower inner(12%), lower outer (8%) and central (14%).⁴⁶Most of the studies show

that both malignant and benign lesions are more common in upper outer quadrant which is in conformity with our findings. Studies done elsewhere suggest, like ours, that most patients with breast lumps seem to seek medical advice when the lump size is about 5 cm.^{4,17,18,19}

Ultrasonic studies showed more interesting results. Most of the benign lumps were hypoechoic (74%) or mixed echogenic (26%). On the other hand, only 2% of the malignant lesions were hypoechoic. The rest of them were either isoechoic (30%) or mixed echogenic (50%) ($p < 0.001$). Thus, the echogenicity status of a breast lesion appears to be statistically significant in predicting the malignancy of breast lumps. This is a very different finding from earlier studies by other researchers. The study by Soona et al. reported that hyperechoic and mixed echogenic breast cancers are rare compared to hypoechoic breast cancers. They also concluded that mixed echogenic breast cancers did not behave differently from hypoechoic breast cancers.²⁰

Forty percent of malignant lumps and 14% of nonmalignant lumps were found to have sonologically detectable calcification ($p = 0.85$). The difference was statistically insignificant. On USG, vascularity was present in 75% of malignant and 20% of benign breast lumps. This difference is statistically significant ($p = <0.01$). Ibrahim et al. also conclude that the presence of calcification in the breast lesion is a significant parameter in predicting malignancy ($p < 0.01$). The sensitivity, specificity, PPV, and NPV of the presence of intratumoral penetrating vessels in predicting malignancy were 76.5%, 80.0%, 76.5%, and 80.0%, respectively.²¹ Based on our own study and similar studies by others, we can conclude that vascularity is more frequently associated with malignant lumps than benign lumps.

This study compares inference from USG with histopathology reports as the gold standard for diagnosis of breast lumps. The diagnostic accuracy of ultrasonography was 85%. The sensitivity, specificity, PPV, and NPV of ultrasonography are 80%, 86%, 53.33% and 95.55%, respectively. In a study done in India in 2020, Narula et al. reported that the sensitivity of USG was 84.47 % in benign cases and 90.90% in malignant cases while compared with biopsy reports. In a study by Gurav et al. in the Department of General Surgery Government Medical College, Miraj- Maharashtra (India) in 2018, the sensitivity, specificity, positive predictive value, and negative predictive value of USG were found to be 94.29%, 86.67%, 94.29%, and 86.67% respectively. The diagnostic accuracy was found to be 92%.¹⁸ In another similar study by Ar et al., the validity of USG in the diagnosis of palpable breast lumps was calculated. A sensitivity value of 95%, specificity of 94.10%, and positive and negative predictive values of 95.50% and 93.75% were noted. They were comparable to other similar studies.²² The study by Fatima et al. concluded that Ultrasound has a 100% negative predictive value for breast lesions with probably benign morphology, whether palpable or not.¹¹

The sensitivity of ultrasonography for predicting malignancy in our study is slightly low as compared to similar studies done elsewhere²². However, the specificity of ultrasonography is comparable to similar studies mentioned above. The positive predictive value of ultrasonography is also low, but the negative predictive value is comparable to other studies. So, when USG identifies lumps as nonmalignant, they have a higher chance of

being non-malignant than being malignant when USG identifies a lump as suspicious of malignancy. This could be because, in developing countries like Nepal, where strict follow-up is not done, doctors prefer to have false-positive results rather than missing the case for diagnosis.

Conclusion

USG is more accurate in predicting the nonmalignant nature as compared to the malignant ones. Whenever feasible histopathological correlation should be done in all cases of breast lumps.

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