Original article

J Nepal Health Res Counc 2021 Jul-Sep;19(52): 487-93

DOI: https://doi.org/10.33314/jnhrc.v19i3.3476

Evaluation of Breast Mass by Mammography and Ultrasonography with Histopathological Correlation

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ABSTRACT

Background: Mammography, ultrasound and Magnetic Resonance Imaging are the available modalities for the evaluation of breast masses. Advances and ongoing improvements in imaging technologies have improved the sensitivity of breast cancer detection and diagnosis, but each modality is most beneficial when utilized according to individual traits such as age, risk factors, and breast density. However, pathological diagnosis is most crucial for the treatment of breast masses.

Methods: A cross-sectional study were conducted from January 2017 to April 2018. There were total of 50 patients with clinically diagnosed palpable breast lumps who attended Gynaecological OPD/surgical OPD/medicine OPD in the study period. The patients above 30 years were evaluated by mammography and ultrasound in Department of Radiology, National Academy of Medical Sciences, Bir Hospital. The patients were then send for FNAC/biopsy and histopathology examination. Data were collected and analyzed using SPSS version 16. Specificity and sensitivity of MG and USG individually and in combination to determine the nature of breast lump in relation to histopathological findings were calculated.

Results: Ultrasound had 88.90% sensitivity and 68.80% specificity whereas mammogram had 94.40% and 87.50% sensitivity and specificity respectively. When combined, both sensitivity of diagnosing malignant lesions increases up to 94.4% and specificity decreases up to 31.2%. Most of the variables of ultrasound and mammography (except density of the lesion) had significance in predicting nature of the lesion ($p< 0.05$).

Conclusions: Combined Mammography and Ultrasound had higher sensitivity than sensitivity rate observed for either single modality. A combined Mammography and Ultrasound approach to detect breast diseases was significantly more helpful in accurate evaluation of breast pathologies.

Keywords: Breast; histopathology; mammography; ultrasound

INTRODUCTION

Breast cancer is the second leading cause of overall cancer deaths and the leading cause of cancer death in middle aged women (40-45) years; however, younger women can also be affected.[1] Advances and ongoing improvements in imaging technologies have improved the sensitivity of breast cancer detection and diagnosis. Mammography (MG) is considered "gold standard" in the evaluation of the breast lesions from an imaging perspective. Ultrasound (USG) examination and magnetic resonance imaging are considered as diagnostic techniques and as adjuncts to the pre and postoperative workup.[1] The goal is to detect breast cancer at the earliest possible stage yet keep unnecessary biopsies to minimum.[2] The main aim of this study is to evaluate the sensitivity and specificity of mammography (MG) and ultrasonography (USG) individually and in combination to detect and characterize palpable breast mass with histopathological correlation.

METHODS

This was a cross-sectional study conducted from January 2017 to April 2018 in National Academy of Medical Sciences (NAMS), Bir Hospital, Kathmandu. There were total of 50 patients with clinically diagnosed palpable breast lumps who attended Gynaecological OPD/surgical OPD/medicine OPD in the study period. Patient of more than 30 years with palpable breast lumps who may accept mammography, USG and histo-pathological procedures and gave informed consent were included in the study. Pregnant females with breast lump or refuse for any one procedure and whose histopathological reports could

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not be traced were excluded from the study. Ethical approval from Institutional review board was taken.

The participants underwent both MG (TOSHIBA MAMMOREX PLUS) and USG (HITACHI GE healthcare LOGIC Q6 PRO). This was followed by USG guided FNAC examination and were sent for the histopathology examination. Detailed clinical information were taken. Both views of breast, cranio-caudal and medio-lateral oblique were obtained. USG examination with using a high frequency (7.5 MHZ) linear array transducer and location of a lesion in the breast was annotated. Then, FNAC was performed under USG guidance by the radiologist or biopsy taken from the lump by the pathologist. Those reports were traced and finally all the diagnosis were compared. Criteria for diagnosing mammographic and sonographic findings were shown in table 1.

Table 1. Suspicious mammographic and sonographic findings.

Suspicious mammographic findings	Suspicious sonographic findings
Spiculation	Spiculation (thick echogenic halo)
Irregular or poorly defined margin	Angular margins
Microlobulation	Microlobulation
Calcifications	Calcification
Linear calcification pattern	Duct extension
Branching calcification pattern	Branch pattern
Mass or nodule	Taller than wide
Asymmetric density	Acoustic shadowing
Developing density	Hypoechogenicity

The data were entered using Microsoft excel and analysis were also done using software SPSS (statistical package for social studies) version 16. Univariate analysis of different variables of MG and USG to the histological findings were done using chi square test. P value <0.05 were considered significant. Specificity and sensitivity of MG and USG individually and in combination to determine the nature of breast lump in relation to histo-pathological findings were calculated.

RESULTS

A total of 50 participants with palpable breast lump were included in this study. Majority of the participants were female belonging to 30-50 years groups and only one male. The mean age was 49.24 ± 13.67 years for both benign and malignant masses. Maximum benign lesions were seen in the age group 30-40 years and malignant cases were seen in age group 50-60 years (p value= 0.04) (Figure 1).

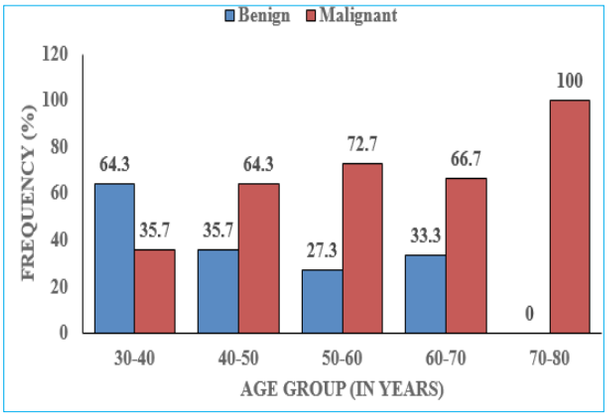

Figure 1. Age distribution of the patients (n=50).

Most of the breast masses were found in upper outer quadrant (58%) irregular shape were observed (48%). Most of the lesions (84%) have increased density in mammogram and very few have decreased or mixed density where only 11 cases (30%) showed calcification. Margin was spiculated in 48% of the patients, micro-lobulated in 20%, obscured and circumscribed in 14% and indistinct in 14% of cases. Skin thickening was observed in 36% and 40% cases. Most of the variables had significant ($p<0.05$) in predicting nature of the lesion expect density of lesion.

In ultrasound, 22 cases (44%) showed hypoechoic echogenicity, 20 (40%) cases with heteroechoic and 8 cases (16%) showed iso-echoic echotexture. Almost 46% had spiculated margin whereas 22% had diffuse ill-defined margins whereas 44% cases had skin infiltration. In 8% of cases, calcification and 32 cases had increased flow in color Doppler. Nearly three-fifth of cases (58%) had enlarged axillary nodes. The commonest lesion was Invasive carcinoma which comprises of 27 (54%) of the cases (Table 2).

Table 2. Different types of breast lesions seen in participants.

Diagnosis	Frequency	Percentage
Ductal Carcinoma	27	54
Fibroadenoma	4	8
Lobular Carcinoma	3	6
Chronic Inflammation	2	4
Abscess	2	4
Phylloid	2	4
Adenosis	1	2
Pagets	1	2

Granulomatous	1	2
Scar	1	2
Sinus Tract	1	2
Fibrocollageneous	1	2
Benign Adenosis	1	2
Mastitis	1	2
Benign Cyst	1	2
Fibrocystic	1	2
Total	50	100

64% of the cases were malignant and 36% were benign on histopathological examinations (Figure 2).

Figure 2. Percentage showing benign and malignant mass according to histopathology.

Most of the cases were suspicious benign falling into BIRADS IV followed by definitely benign (Table 3).

Table 3. BIRADS categorization of USG and mammogram.

BIRADS	Frequency	Percent
I	4	8
II	17	34
III	5	10
IV	20	40
V	4	8
Total	50	100

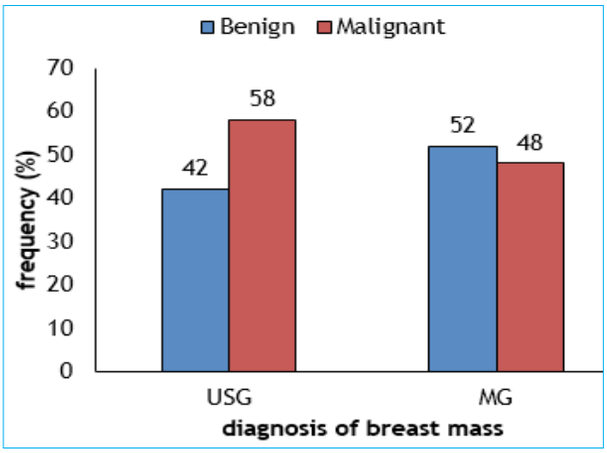

Figure 3. Comparison of mammographic and sonographic diagnosis of breast mass.

Among the total participants, USG diagnosed 58% as malignant and 42% as benign. Mammography diagnosed 52% as malignant and 48% as benign (p value < 0.001) (Figure 3).

Ultrasound had 88.90% sensitivity and 68.80% specificity whereas mammogram had 94.40% and 87.50% sensitivity and specificity respectively. When combined, both sensitivity of diagnosing malignant lesions increases up to 94.4% and specificity decreases up to 31.2 %. There are some images showing benign and malignant lesions. (Figure 4.A, B; 5.A,B).

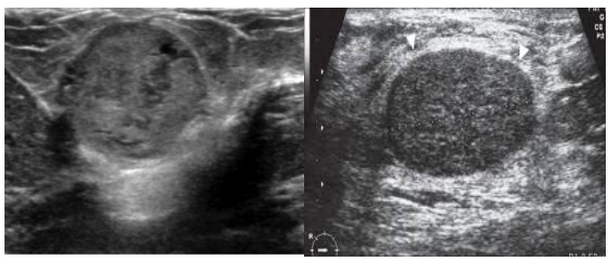

Figure 4. A, B USG features showing Ductal carcinoma and Fibroadenoma

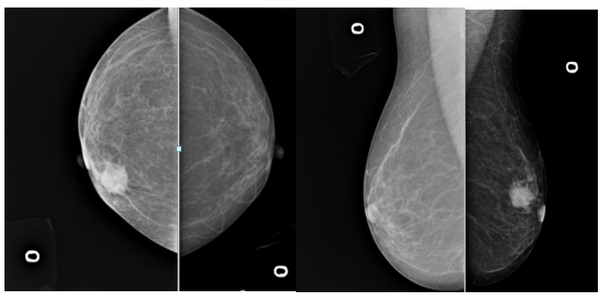

Figure 5. A, B Mammogram showing radioopaque lesion in outer quadrant of left breast and well defined lesion in upper quadrant of left breast.

DISCUSSION

The age of participants ranged from 30-80 years. The mean age was 49.24 ± 13.67 years. Maximum were females (98%) in the age group 30-50 years. When calculated separately, maximum benign lesions were seen in the age group 30-40 years and malignant cases were seen in age group 50-60. Majority of female participants were found in this study due to rarity of male breast lesions (2%). Male breast cancer (MBC) is a rare disease, accounting for less than 1% of all breast cancer diagnosis worldwide.[3,4] Most of the breast masses were found in upper outer quadrant (58%). Andrew H.S. Lee stated proportion of core biopsies from the upper outer quadrant reported as normal (67%, 95% confidence interval 59-74%), benign (57%, 95% confidence interval

51-63%) or malignant (62%, 95% confidence interval 57-67%).[5] The high proportion of upper outer quadrant carcinomas of the breasts is a reflection of the greater amount of breast tissue in this quadrant. There was no significant correlation of the quadrant with type of lesion (benign vs. malignant (p>0.05).[5]

Most of the breast lesions appeared high density (84%) in this study. Jackson et al studied radiographic densities of 91 biopsy proven, non-fatty, non-calcified breast masses. The density determinants made by each observer were compared with the histologic outcome of the 51 benign and 40 malignant lesions.[6] As a solitary feature in lesion analysis, mammographic density is difficult to assess and is limited value for the prediction of the benign and malignant nature of non-calcified breast masses.[6] In this study also, there was no significant correlation of breast density with breast malignancy (p value >0.05).

Except lobular, all other types of shapes (round, oval and irregular) were equally seen in this study. Oval and irregular shapes were seen in 34% and 48% of cases respectively. The different shapes were seen in different breast lesions and one particular shape did not have higher chances of malignancy. Liberman L et al reported that benign mass had morphological appearance showing well defined margins (98%) and round or oval shape.[7] Rahbar G et al described as US features that most reliably characterize masses as benign included a round or oval shape (94%) and circumscribed margins (91%). Features that characterize masses as malignant included irregular shape (61%), microlobulated (67%) or spiculated (67%) margins and width-to-AP dimension ratio of 1.4 or less (40%).[6] In this study when shape were correlated with chances of malignancy, it was not significant (p value >0.05). In our study, most of the malignant lesions had spiculated margins. Liberman L et al reported that benign mass has morphological appearance showing well defined margins (98%) and round or oval shape. The great majority of the lesions are fibroadenoma and cyst, however malignant lesion including medullary, papillary, mucinous as well as some ductal carcinoma can present as circumscribed mass. Most of the malignant masses had spiculated margins.[7] Huang SF stated that spiculation is a stellate distortion caused by the intrusion of breast cancer into surrounding tissue. Its existence is an important clue in characterizing malignant tumors.[8] Margin is regarded as one of the most important feature to differentiate benign and malignant breast lesions. In this study also, margin was statistically significant for malignancy (p value <0.05). Calcifications were seen in 39 cases in our study.

When breast density were correlated with histopathological findings of malignancy, most of the malignancies were found in type IV breast parenchyma. Sartor H et al found that tumors presenting as an ill-defined mass or calcifications were more common in dense breasts. Spiculated appearance was related to invasiveness and ill-defined mass to larger tumor size, regardless of mode of detection and breast density.[9] However, the finding that malignancy was more common in fatty breast is most likely due to age of the patient as in older patients fatty breast is more common.

When participants were evaluated for skin thickening, most of them had normal skin. Only 36% had skin thickening. Leivonen MK did a study on mammary skin thickening as a prognostic sign in breast cancer. They claimed that mammary skin edema measured from mammograms of breast carcinoma patients is a valuable prognostic sign. The thickening did not correlate with involved axillary nodes but correlated with the disease-free interval provided that the thickening was over 1.5 mm above the tumor or over 0.75 mm in the inferior part of the breast.[10] However in this study there was no correlation between malignancy and skin thickening (p value >0.05).

The echogenicity of the lesion were predominantly hypoechoic in this study. About 44% of cases were hypoechoic. None of the cases with hyperechogenicity was noted. Kuzmiak CM et al found that echo pattern being another distinguishing feature between the groups (P <0.01). Benign papillomas (87%) and cancers (71.4%) were predominately hypoechoic, whereas high-risk lesions more frequently (71.4%) showed a complex echo pattern.[11] Erol B et al found that difference between lesion echogenicity ratio values of benign and malignant lesions was statistically significant (p<0.01).[12]

The increase in color flow was associated with malignancy with high significance (p value <0.01). Wang LC et al described the presence of internal vascularity to increase the positive predictive value of US.[13] Ueno E stated that color doppler has also been developed and has contributed to the diagnosis of breast cancer.[14] Shaheen R et al found that multiple peripheral vessels with low resistance flow was the pattern most significantly associated with all appearance of focal breast cancer. Apart from a positive correlation with solid tumors, markedly high RI in cystic tumors and markedly low RI in tumors less than 2 cm, there was no consistent correlation trend difference between doppler findings and tumor size. Therefore, histopathology remains the main modality to evaluate the tumor type and characteristics.[9]

Out of 50 cases, almost 58% cases had significant lymphadenopathy. Whenever lymphadenopathy was present, it was highly significant for malignancy. The status of lymph nodes and the maximum diameter of breast carcinomas are most important prognostic indicators for invasive breast carcinoma. Metastatic lymph nodes tend to become abnormally round in shape, but unfortunately this is a late finding. The morphologic finding of eccentric cortical thickening is much more sensitive than "rounding" of the lymph node.[15] In this study most of the lesions were malignant. Our center being tertiary center is the referral center from all over Nepal. So, maximum patient undergoing mammography were recommended for FNAC and Trucut biopsy have high index of suspicion. That may be the reason we came across maximum malignant lesions as compared to benign ones.

Invasive carcinoma was the commonest lesion of all (54%) followed by Fibroadenoma (8%). Anyikam A et al found that fibroadenoma was the most common lesion (44%), occurring at a mean age of 16-32 years. Next was fibrocystic changes (22.9%) at a mean age of 23-45 years. Benign breast lesions peaked at 20-24 age range and then declined. Benign breast lesions occur more frequently than malignant breast lesions with a ratio of 2.3:1 and were presented 20 years earlier than their malignant counterparts.[15]

When breast masses were evaluated by mammography and its diagnosis were correlated with histopathology, the sensitivity and specificity was 94.40% and 87.50% respectively. McCavert M et al found mammography to be more sensitive in patients over 50 years compared with those patients under 50 years (62.5% vs. 45.7%, p = 0.10).[16] Comparing the sensitivity of MG and USG according to the breast density indicates that mammographic sensitivity was 82.2% among women with predominantly fatty breast. With the increase of fibro glandular density the level of sensitivity with mammography decreases, while ultrasonographic sensitivity was 71.1% among women with predominantly fatty breast and 57 % for heterogeneous dense breasts.[17] Findings of our study were similar to these literatures.

The sensitivity and specificity of sonography were 88.90% and 68.80% respectively. Candelaria RP et al found that breast ultrasound plays a major role in the identification, diagnosis and staging of breast cancer.[18] In a study done by Shahid R et al, the sensitivity of ultrasound for malignant lesion was 95.24% and specificity was 68.75% for a benign lesion.[19] Lister D et al conducted a study to establish the accuracy of USG in detecting invasive malignancy in clinically benign, discrete, symptomatic breast lumps. USG had significantly better accuracy (97% vs. 87%, P < 0.02), sensitivity (93% vs. 57%, P < 0.05) and negative predictive value (99% vs. 92%, P < 0.002) than mammography in the detection of invasive carcinoma when indeterminate and malignant imaging findings were taken as positive.[20]

Skaane P described USG as a valuable adjunct to MG in patients with non-conclusive mammographic findings. The overall additional value of USG to MG in the diagnosis of breast cancer was rather limited in a population of mixed malignant tumors. USG correctly upgraded more than 40% of palpable and non-palpable malignant tumors.[21] Zonderland HM et al found the sensitivity of mammography was 83% and specificity was 97%. After US, the combined sensitivity increased to 91% with a specificity of 98%. The use of US as an adjunct to mammography resulted in an increase in diagnostic accuracy. Its contribution to the diagnosis of breast cancer in their study was 7.4%.[22] Shetty MK et al found sensitivity and negative predictive value for a combined mammographic and sonographic assessment were 100% and specificity 80.1%. Combined mammographic and sonographic assessment were shown to be very helpful in identifying benign as well as malignant lesions causing palpable abnormalities of the breast.[23] Moss HA et al stated in predicting final histology, sensitivity and specificity of mammography alone were 78.9 and 82.7% respectively, of ultrasound alone were 88.9 and 77.9% respectively and of mammography and ultrasound in combination were 94.2 and 67.9% respectively.[24] The sensitivity and specificity of combined MG and USG seen in our study was comparable to the published literatures. Combined diagnostic modality yielded better sensitivity as compared to individual test.

CONCLUSIONS

Combined MG and USG had higher sensitivity than sensitivity rate observed for either single modality. A combined MG and USG approach to detect breast diseases was significantly more helpful in accurate evaluation of breast pathologies than when either modality was used alone. Ultrasound had 88.90% sensitivity and 68.80% specificity whereas mammogram had 94.40% and 87.50% sensitivity and specificity respectively. When combined both sensitivity of diagnosing malignant lesions increases up to 94.4% and specificity decreases up to 31.2 %. Therefore, this study suggests that any patient who is advised to go for a single modality of investigation should rather be investigated using the combined modality.

ACKNOWLEDGEMENTS

We would like to thank technical staffs in the Mammography department as well as pathologists during their duty schedules who helped us for doing the scans according the protocol of the department. We also like to thank Institutional review board for accepting our proposal.

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Competing interests: None declared

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