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Color Doppler Of Breast In Diagnosis Of Breast Carcinoma: Comparative Study With Mammography And Usg

Arnab Adak[1], Shibsankar Raychaudhury[2]
[1]*Senior Resident, Department of Surgery, Medical College Kolkata and Lady Dufferin Victoria Hospital*
[2]*Associate Professor, Department of Surgery, Medical College Kolkata*
corrosponding author:Arnab Adak

Abstract:*Breast cancer is the second most common cause of death from cancer in women. The aim of this study was to determine which is more accurate imaging test among mammography ,ultrasound and color doppler ultrasound for diagnosis of breast cancer based on the women's age and breast density. We examined 81 patients with breast symptoms, by clinical breast examination which is cofirmed by mammography ,ultrasound and color doppler. A total of 81 breast lesions were compared with final histopathology of the lesion taking it as the gold standard. Sensitivity varied significantly with age and breast density. Adding color Doppler with ultrasound provides a better diagnostic accuracy.*
Keywords: *breast cancer, diagnostic methods, mammography, ultrasound,color doppler ultrasound, age.*

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I. Introduction:

Breast cancer is the most common type of cancer in women today, accounting for 1 of every 3 cancers diagnosed. Approximately 1 in 8 (12%) woman has a chance of developing invasive breast cancer. It is one of the leading causes of cancer mortality among women [1]. Breast cancer is a heterogeneous disease with multiple causes. Epidemiological studies have identified many risk factors . Important risk factors for female to develop breast cancer include early age at onset of menarche, late age at onset of menopause, a first full-term pregnancy after the age of 30 years, a family history of premenopausal breast cancer and a personal history of breast cancer or benign proliferative breast disease. Obesity, nulliparity, and urban residence are also considered as risk factors. Mammography detects breast cancer early. It detects about 75% of cancers at least a year before they can be felt. Mammography is two types mainly: screening and diagnostic. Screening mammography is done in asymptomatic women. Early detection of breast cancers by screeningmammography greatly improves chances for successful treatment. Screening mammography is recommended every 1-2 years for women after reaching 40 years of age and every year after reaching 50 years. In some instances, physicians may recommend screening mammography before age 40 if the woman has a strong family history of breast cancer. Studies have shown that regular mammograms may decrease the risk of late-stage breast cancer in women 40 years of age and older[2,3]. Diagnostic mammography is performed in symptomatic women, when she have a breast lump or nippledischarge during self-examination or in case of any abnormality detected in screening mammography. Diagnostic mammography is more involved and time-consuming than screening mammography and is used to determine exact size and location of breast abnormalities and to image the surrounding tissue and lymph nodes. Mammography sometimes give false positive results. According to data from the Breast Cancer Detection Demonstration Project, the false- negative rate of mammography is approximately 8 to 10 %. Approximately 1 to 3 % of women with a clinically suspicious abnormality, a negative mammogram, and a negative sonogram may still have breast cancer. Breast lesions are sometimes missed because of dense parenchyma obscuring a lesion, poor positioning or technique, observers perception error, incorrect interpretation by the sonologist, subtle features of malignancy, and slow growth of a lesion.[4]. Ultrasonography has been playing an increasingly important role. In the case of a patient without symptoms and in women with dense breast tissue breast ultrasound is ascribed a higher sensitivity for detecting breast cancer. It also plays an important role in women under the age of 50. Breast US have been enumerated for evaluation of a palpable mass incompletely evaluated at mammography and also for differentiation of a cystic from a solid nodule. Mammographically occult cancers can be detected by ultrasound in 10 to 40% of thecases depending on the patient's breast density and age [5,6,7].The use of color Doppler ultrasonography (CDUS) for characterizing breast lesions has increased recently . The presence and distribution of blood vessels associated with malignant lesions, resistive index (RI), pulsatility index, and flow velocity are used to differentiate benign and malignant lesions. In most of the studies are RI differentiates between malignant and benign lesions. However, different sensitivities, specificities, and positive and negative predictive values have been reported. [8].

II. Materials And Methods:

81 women with breast symptoms were examined and followed up over a period of 18 months. The age ranges from 38 to 73 years with mean age of 52 years standard deviation (SD) of 8.21 .

Breast lesions were detected by clinical breast examination, mammography, ultrasound and color doppler of breast. A total of 81 breast lesions were identified as carcinoma breast by histological methodology. Imaging techniques were compared, sensitivity and specificity were analysed taking histopathology as the gold standard.

To each patient, detailed history was taken including: age at first childbearing,age at menarche, age at menopause,history of breastfeeding,number of children, history of hormone therapy, history of premenopausal breast cancer for a mother and a sister, a personal history of breast cancer, benign proliferative breast disease, radiation and smoking .

Physical examination

Clinical breast examination of the whole breasts and axillary regions -

Sitting position with arms both lowered and raised. In an sitting upright position, we visually inspects the breasts, noting asymmetry, nipple discharge, obvious masses, and skin changes, such as dimpling, inflammation, rashes, and unilateral nipple retraction or inversion. With the patient supine and one arm raised , we thoroughly palpated breast tissue, axillary regions and supraclavicular areas, assessing the size, texture, and location of any masses. After the patient history is obtained and the clinical breast examination is performed, the next diagnostic step was mammography, ultrasound, color Doppler and biopsy.

Mammography

Conventional film-screen mammography was performed with at least two views- medio-lateral oblique and cranio -caudal views. Additional views or spot compression views were obtained where needed. Mammograms were described with dedicated mammography units (Alpha RT Imaging, General Electric Medical Systems, Milwaukee). Mammograms were interpreted according to the Breast Imaging Reporting and Data system (BI-RADS)diagnostic categories on a five-point scale, with BI-RADS 1 (negative),2 (benign finding), 3(probably benign), 4 (suspicious malignancy), and 5 (highly suspicious of malignancy).

Breast Ultrasound

Breast ultrasound was performed by the same radiologist who had interpreted the mammograms of that patient. Ultrasound examinations were performed using a high-resolution unit (AlokaSSD ; Tokyo, JapanandMindray DP Plus) with a linear array probe centred at 7.5 MHz. All ultrasound examinations were performed in a supine position for the medial parts of the breast and for the lateral parts of the breast it was done in a contra-lateral posterior oblique position with arms raised. The whole breasts were scanned.Diagnoses were scored on a five-point scale identical to the mammographic BI-RADS categories.

Breast color Doppler

The use of color Doppler ultrasonography (CDUS) of breast for characterizing breast lesions has increased in recent times. Increased vascularity and penetrating distribution of blood vessels associated with malignant lesions. Doppler criteria such as resistive index (RI) and flow velocity are used to distinguish benign from malignant lesions. Most of the studies are based on comparison of resistive index between malignant and benign lesions. However, different sensitivities, specificities, and positive and negative predictive values have been reported[9].The main aim of this study is to assess the vascularity and resistive index in evaluating solid breast lesions and to compare it with histopathology results, and to evaluate its accuracy in diagnosis of breast carcinoma .

Histopathological examination

A total of 81 breast lesions were turned out to be suffering from breast carcinoma as confirmed by histological methodology.FNAC were done for all T1, T2, T0N1 lesions. Though tru-cut bipsy is recommended it takes a longer period of time for diagnosis. Patients revisit OPD at a latter date with advenced staging. Tru-cut werefor all T3 lesions. Trucut biopsy were also done in a cases where patient needed neo-adjuvant chemotherpy and also in cases where FNA suggested it to be benign but lesion had increased vascularity on color doppler. Final histologic diagnosis was obtained for all patients who underwent surgical biopsy, and all cases were verified by reviewing the final histopathology report after surgery. Histopathology results revealed the presence of 75 ductal cancers and 6 were lobular carcinoma. The 5 benign cases were excluded as per exclusion criteria.

Of these 75 cases, 2 were found to be benign in FNAC, later found to be malignant on excisional biopsy.,1 case of axillary LN(T0N1) found to be ductal carcinoma on FNAC.

III. Resuts And Analysis:

81 cases minimum age of 38yrs old and maximum age of 73 yrs were taken for studies with mean 52, median 52 and standard deviation 8.1. Out of 81 cases 37 were less than 50 years of age.

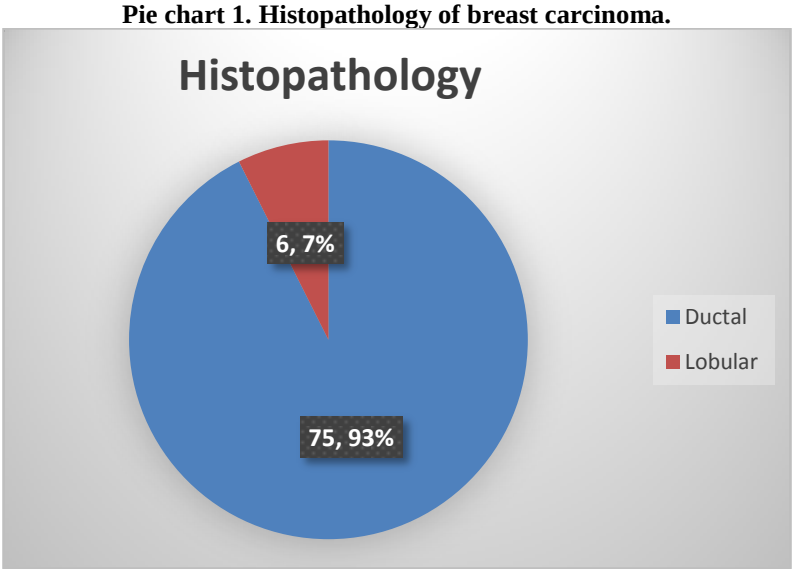
Clinical and Histopathological:

Clinically cases classified as per TNM staging. 65.43% of cases were T2, 67.9% cases were N1. Maximum cases observed were T2 N1(Table 1).Maximum cases (75 out of 81) were ductal carcinoma and 6 were lobular carcinoma.(Pie chart. 1)

Table 1. Tumor and Nodal staging

		n	%
T_stage	Tis	1	1.23
	T0	1	1.23
	T1	12	14.81
	T2	53	65.43
	T3	14	17.28
N stage	N0	10	12.34
	N1	55	67.90
	N2	14	17.28
	N3	2	2.47

Pie chart 1. Histopathology of breast carcinoma.



Imaging:

The Mammography reports collected. The BI- RADS classification used to grade.Mainly three grades were observed.Grade 4 suggested suspicious lesion while Grade 5 suggested highly suspicious of carcinoma. 13.58% cases showed highly suspicious carcinomatous lesion (Table 2).The sonomammography reports collected. The BI- RADS classification used to grade.Mainly two grades were observed.Grade 4 suggested suspicious lesion while Grade 5 suggested highly suspicious of carcinoma. 19.75% cases showed highly suspicious carcinomatous lesion(Table 3).

BIRADS 3 on both mammography and USG simultaneously found in 3 cases , found to be malignant on biopsy. One case of Pagets disease of breast found BIRADS 3 but decreased vascularity on color doppler, later found to be malignant on biopsy. One case found to be fibroadenoma on FNAC but excisional biopsy of lump suggested it to be invasive ductal carcinoma. One case of T0N1 found to be ductal carcinoma on FNAC

from axillary LN. BIRADS 3 on mammography(Fig 1) and BIRADS 4 on USG(Fig 2) found in one case, color doppler showed increased vascularity(Fig 3). FNAC suggested that to be fibroadenoma, but on the basis of color doppler report core neddle biopsy was performed, suggested it to be invasive ductal carcinoma.

8 out of 81 cases, 9.88% cases found to be suggestive of malignancy on both Mammography and USG breast. Crosstabulation between USG and mammography was done(Table 4), the p value was found significant(p=0.0001). All patients with BIRADS 3 on Xray mammography and/or sonomammography with proven malignancy were below 50 years of age.

Table 2. Mammography findings

		n	%
Mamography	BI-RADS Grade 3	4	4.94
	BI-RADS Grade 4	66	81.48
	BI-RADS Grade 5	11	13.58

Table 3. USG findings

		n	%
USG	BI-RADS Grade 3	3	3.70
	BI-RADS Grade 4	62	76.54
	BI-RADS Grade 5	16	19.75

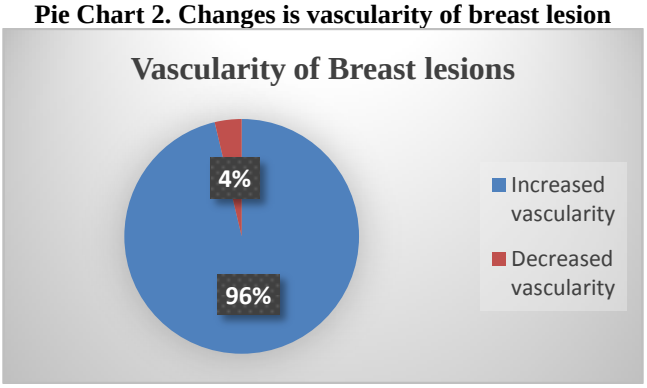
Table 4. Comparative study between mammography and USG with respect to age

		USG	BIRADS 3	BIRADS 4	BIRADS 5	
	Mammography					**Total**
<50 years	BIRADS 3		3	1	0	4
	BIRADS 4		0	25	4	29
	BIRADS 5		0	1	3	4
	Total		3	27	7	37
>/=50 years	BIRADS 3		0	0	0	0
	BIRADS 4		0	33	4	37
	BIRADS 5		0	2	5	7
	Total		0	35	9	44

Comparative study betwween standard imaging techniques and color Doppler of breast:

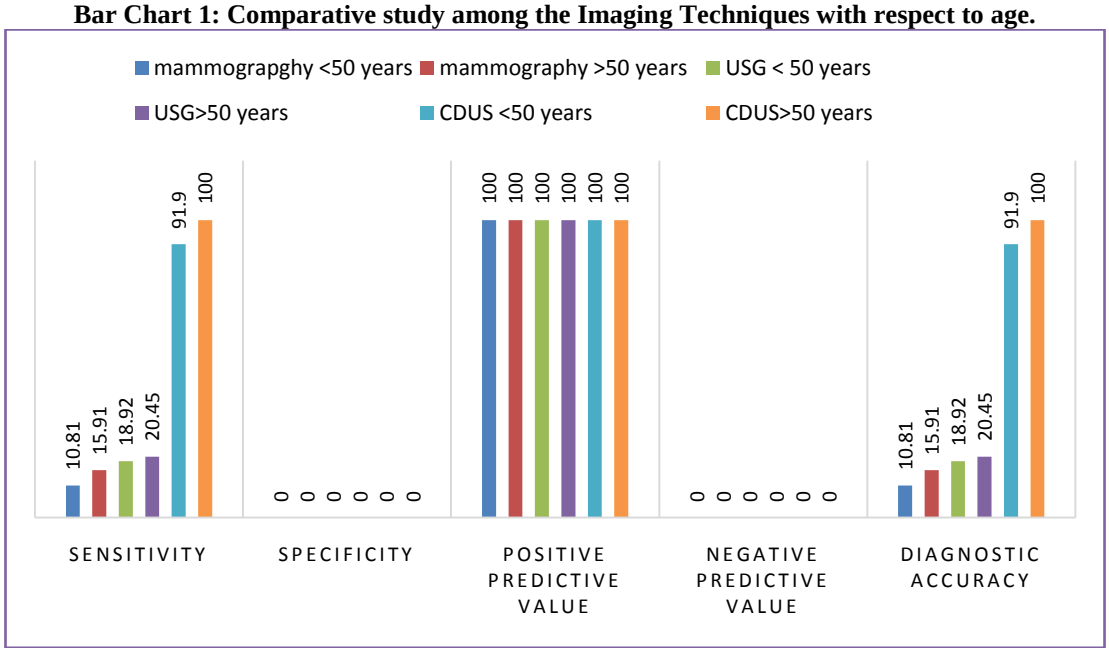
When mammography was compared with HPE (gold standard) 13.58% cases showed grade 5 lesion suggesting confirmatory diagnosis.The sensitivity estimated the same.Specificity could not be commented as benign lesions were excluded from study.While sensitivity in patients >50 years was 15.91% and in patients <50 years was 10.81% .When USG was compared with HPE (gold standard) 19.75% cases showed grade 5 lesion suggesting confirmatory diagnosis.The sensitivity estimated the same.Specificity could not be commented as benign lesions were excluded from study.While sensitivity in patients >50 years was 20.45% and in patients <50 years was 18.92% .Vascularity is increased in 96.30% cases(Pie Chart 2). Vascularity is decreased in all cases found to be BIRADS 3 on mammography and USG simultaneously. One case of BIRADS 3 on mammography shows increased vascularity on color doppler is seen in the study.

Pie Chart 2. Changes is vascularity of breast lesion



Sensitivity is 100% in color doppler study of breast in patients >50 years of age and sensitivity is 91.9% in patients of age<50 years. Positive predictive value is 100%. Negative predictive value is 0.00%.

Bar Chart 1: Comparative study among the Imaging Techniques with respect to age.



Results of color Doppler ultrasound study:

96.30% were found to have increased vascularity. All those with age more than 50 years were found highly vascular(Table 5). Resistive Index were calculated in the Color Doppler Ultrasound study. Mean RI is 0.81. Median RI is 0.82.RI ranges from 0.62 to 0.87. 20 cases were found to have RI <0.8 of which 3 were <0.7. 61 cases(75.3%) were found to have RI >0.8(Table 6) . RI is >=0.8 in all the 35 cases(100%) of grade 3 breast cancers and <0.8 in all the 10 cases(100%) of grade 1 breast cancers(Table 7).

Table 5. Comparative study of change of vascularity of lesion with respect to age

Color doppler	Increased vascularity	Decreased vascularity	total	Proved malignancy
<50 years	3 4	3	3 7	3 7
>50 years	4 4	0	4 4	4 4

Table 6. Comparative study between increased vascularity and Resistive index

Vascularity	RI	>=0.8	<0.8
Increased		61	17
Decreased		0	3

Table 7. Comparative study between Resistive index and tumor grading

Resistive Index(RI)	>/=0.8	<0.8
grade 1	0	10
grade 2	26	8
grade 3	35	0

IV. Discussion:

Breast cancer, is an important health problem in India. In the last decades there is little increasing of knowledge and development of breast cancer management, which resulted in increasing of mortality rates from breast cancer. All women may developbreast cancer at any point of time. The older a women have greater chances. Approximately 77% of breast cancer cases occur in women who is more than 50 years of age. Most important stepto reduce death from breast cancer is early detection. Early detection and treatment is needed to prevent breast cancer to metastasise. Mammography and ultrasound are the two standard imaging techniques for detection and evaluation of breast disease including breast cancers . Malignant neoplasm of breasts, need angiogenesis for further growth and metastasis. Hence malignant tumors are more vascular. Thus, a technique such as Doppler sonography with the ability tovisualize the blood vessels might be useful for differentiating benign and malignant breast lesions. This study was designed to determine the value of Doppler sonography and Resistive Index in distinguishing benign from malignant breast lesions.The main finding of this study was that malignant breast lesions are more vascular than the benign lesions, in corroboration with previous studies [9]. In the previous study, blood vessels were detected in 97.4% of the malignant group and only 35% of the benign group. This difference was statistically significant. In this study 96.3% were found more vascular.

A significant number of BIRADS 4 on USG and Mammography were found malignant. One case of BIRADS 3(Fig.1) on mammography had increased vascularity on color Doppler(Fig 3) which on histopathological examination found to be malignant. Color Doppler in not diagnostic but adding it to standard Ulrasonography gives ab better imaging.

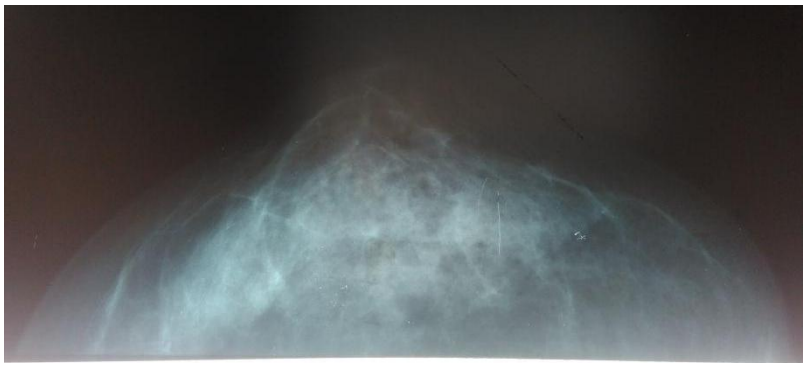


Fig. 1.

Fig. 2

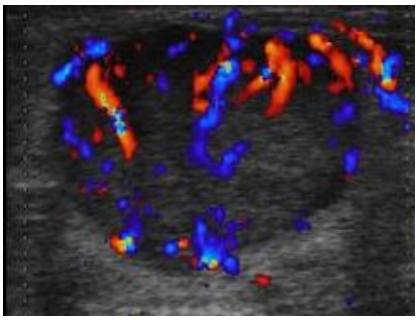


Fig 3.

V. Conclusion:

Our results indicate that breast density and age are important predictors of the accuracy of mammography and USG breast. USG breast provides better diagnostic criteria of a lump suggestive of malignancy than mammography in the selected population. Sensitivity and diagnostic accuracy is better in elder age group.Adding Color Doppler ultrasound to the standard imaging techniques provides a better diagnostic accuracy of a lump, even better in the elder age group(>50 years)Overall accuracy of USG is better than Mammography and it is cost friendly so can be used to evaluate a lump of suspected Ca breast in a better way. Color Doppler study may be done in addition to USG to get a better detection rate.

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