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Original Research Paper

Radio-Diagnosis

A COMPARATIVE STUDY ON PREDICTIVE VALUE OF MALIGNANCY IN SUSPICIOUS BREAST MASSES USING DR-MAMMOGRAPHY AND ULTRASONOGRAPHY

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ABSTRACT Breast cancer remains the leading cause of cancer-related deaths among women worldwide, except in the most economically developed nations where lung cancer surpasses it. In younger women and those with dense breasts, ultrasound proves to be more accurate, while mammography shows improved sensitivity in women aged 60 and older. This study aimed to compare the diagnostic efficacy of digital mammography (DR-mammography) and B-mode ultrasound in detecting suspicious breast masses. Specifically, the study sought to analyze the mammographic and ultrasonographic characteristics of breast lesions, categorize them according to the BI-RADS system, and correlate these findings with histopathological results. The study underscores the importance of a multimodal imaging approach in the evaluation of breast lesions.

KEYWORDS : DR mammography, ultrasonography, screening, Breast cancer, BI-RADS (Breast Imaging Reporting and Data System), Diagnostic accuracy

INTRODUCTION:

Among different cancers occurring in women, breast cancer is leading cause of female cancer deaths in almost all countries, with the exception of the most economically developed, in which breast cancer is the 2nd most common cause after lung cancer. [1]

According to global cancer statistics 2020, in female also, lung cancer is most common cancer followed by breast cancer and thus lung cancer became the leading cause of cancer incidence in the world in the year 2020. [2]

In women with mass or lesions in dense breast, the sensitivity of mammography reduces. In such conditions, ultrasound and mammography is an appropriate diagnostic tool to detect breast cancer.[4] Combined diagnostic approach comprising of clinical examination, radiology, FNAC and biopsy in suspected cases of breast cancers which improves the diagnostic efficiency of breast cancers and reduce morbidity and mortality.[3]

Mammography is an important screening tool that helps to reduce the mortality due to breast cancers by early identification of small preclinical lesions and also lymph node negative breast cancers.

The gold standard imaging for breast cancer screening is mammography. But in patients with dense breast tissue, the sensitivity of mammograms decreases.[5] B mode ultrasound is supplementary modality in such patients. Its easy availability, low cost, lack of radiation exposure, and lack of intravenous contrast administration is advantage. However, the specificity continues to be low when compared to mammography. The sensitivities of mammogram and USG in the case of patients with dense breast tissue are 56% and 88% respectively whereas the sensitivities of mammogram and USG in non-dense breast tissue are 80% and 88% respectively.

AIM & OBJECTIVES

- To compare predictive value of malignancy in suspicious breast masses using DR-mammography and ultrasonography.
- To categorize the detected breast lesions according to BI-RADS.
- To compare the morphological features of breast mass by mammography and B-mode USG.
- To correlate the categorized breast lesions (BI-RADS) with histopathology.

MATERIAL AND METHODS

Study Design - Prospective study for duration of 24 months.

Sample Size- A total of 100 patients had been included in the study. All participants will be females of more than 30 years of age with suspicious breast lesions on imaging who provides consent to take part in the study.

Institutional ethics committee approval was obtained. No external funding received for this work and none of authors report relevant conflict of interest.

Inclusion Criteria:

- All women with breast lump coming to our center who underwent B-mode USG and mammography.
- All women with breast cancer who had been referred to the institute and who underwent imaging in our center.
- Female breast cancer patients with histopathological reports.
- Family history of breast carcinoma.

Exclusion Criteria:

- Women unwilling or unable to undergo biopsy/surgery.
- Patients who did not give consent to participate in the study had been excluded.
- Pregnant women.

The study was done using various modalities like B-mode USG and DR-mammography for breast mass and correlated it clinically. This study had been carried out at our department of Radiodiagnosis, tertiary care teaching hospital.

Results had been checked by two radiologists (PI and CO-PI) and final comparative data had been prepared from B-mode USG and mammography.

Equipment:

DR-Mammography:

- Fuji Film - full field digital mammography machine (amulet innovality).

- Mammography images of the breast were obtained by compression of the breast tissue. Two imaging projections of each breast, cranio-caudal (CC) and medio-lateral oblique (MLO) views are obtained.

Ultrasonography:

- Samsung RS 80: Curvilinear probe and Linear Probe

Methods Of Collecting Data:

All the patients included in this study were referred from surgery department of our hospital to Radiology department for B-mode USG and mammography. After that patients are recommended for core biopsy or operative procedure in surgery department. Histopathological data of the patients had been collected from pathology department.

Statistical Data Analysis

Data had been entered in Microsoft excel sheet, tabulated and had been analysed using IBM statistical package for the social sciences (SPSS) software. To describe the data descriptive statistics frequency analysis, percentage analysis had been used.

RESULTS:

A study was conducted on 100 patients referred to the Department of Radiodiagnosis for breast lesion evaluation. All data was complete with no missing information. The patients' ages ranged from 30 to 65 years. Among the 100 patients, 80 had mammography and ultrasonography due to concerns about a lump in the breast, while 14 underwent screening, 4 experienced breast pain, and 2 reported nipple discharge.

On mammography, 63 patients (the majority) had fibro-fatty breast tissue. A total of 95 lesions were detected, with 5 remaining undetected. Of these, 39 lesions (the most common) were located in the upper outer quadrant, followed by central breast locations.

The shapes of lesions—whether oval, round, or ill-defined—were similarly distributed on both mammography and ultrasonography. In terms of margins, 39 of the 95 lesions exhibited lobulated edges, 30 had indistinct margins, 14 were well-circumscribed, and 12 had spiculated margins. Density analysis revealed that 60 lesions were high-density, while 18 had low density and 16 were of equal density on mammography. Only one lesion contained fat.

Calcification patterns varied: 49 lesions had no calcifications, 18 had coarse, 26 had fine, and 2 exhibited amorphous calcifications. The overlying skin appeared normal in 76 patients; however, 12 had skin thickening, 1 showed nipple retraction, and 6 had both skin thickening and nipple retraction.

Mammography findings indicated that 13.6% of lesions were benign (BI-RADS 3), 40% were highly suspicious for malignancy (BI-RADS 5), and 46.3% were categorized as suspicious for malignancy (BI-RADS 4).

Ultrasonography detected 99 lesions, with the most common margin being lobulated, and the least common being angulated. Of these lesions, 86 were hypoechoic, followed by 8 solid-cystic, 4 heterogeneous, and 1 hyperechoic. Posterior acoustic features were absent in 34 lesions, while 28 showed enhancement, 30 exhibited shadowing, and 7 displayed combined features. Additionally, 56 lesions were wider than they were tall, with the rest showing the opposite ratio.

Regarding lymph nodes, ultrasonography revealed that 16% of patients had metastatic lymph nodes, while 84% did not. Infiltration of muscle and chest wall structures was seen in 9 cases, while 90 cases showed no such infiltration. As in mammography, the most common lesion location was the upper outer quadrant (43 lesions), followed by the central area.

On ultrasonography, 15.2% of lesions were categorized as probably benign (BI-RADS 3), 40.4% were highly suspicious for malignancy (BI-RADS 5), and 44.5% were suspicious for malignancy (BI-RADS 4).

Fine-needle aspiration cytology (FNAC) confirmed that out of 100 lesions, 33 were benign, and 67 were malignant. Patients were categorized as having benign or malignant lesions based on mammography and ultrasonography reports, as presented in tables 1.

Table-1: Distribution Of Patients Based On Sonomammography Report

Sonomammography report		Number	Percentage (out of 95) (%)
mammography report	Benign	34	35.7
	Malignant	61	64.2
Sonography report	Benign	37	37.7
	Malignant	62	62.6

BI-RADS category of 4b was used as the cutoff for distinguishing between benign and malignant lesions.

High-density lesions were predominantly malignant, and all lesions with spiculated margins on mammography were confirmed as malignant through FNAC or histopathology. On ultrasonography, all spiculated and angulated marginated lesions were positive for malignancy, while most well-circumscribed lesions were benign, except for four. BI-RADS 3 lesions were consistently benign, although one lesion categorized as BI-RADS 5 was benign based on histopathological results.

DISCUSSION:

A total of 100 females who were found to be have suspicious breast lesions and had positive findings on both mammography and ultrasonography included in the study.

The highest percentage of patients with lesions positive for malignancy was in the age group ranging from 41-60 years which accounted to 35.8 %. A study by Damodardas Akruwala also shows maximum numbers of breast cancers between 41-50 years age group which is consistent with our findings.[6]

In our study most of the tumors were seen in the upper outer quadrant followed by central quadrant of breast. Central quadrant includes tumors involving the retro areolar region, upper central, lower central, inner central and outer central quadrants. Only few cancers were seen in lower outer and lower inner quadrants of breast. Study by Rummel S et al showed that the most frequently involved quadrant of breast in breast cancer is upper outer quadrant and less frequently seen in inner quadrant of breast which is consistent with our findings.[7]

In our study, out of 65 malignant lesions detected on mammography, 35 (53.8 %) were having calcification on mammography. Study by X. Wang et al showed that 48% malignant lesions were found with calcifications on mammography.[8]

46.2 % of the breast lesions without any calcification were positive for malignancy from which we could conclude that not all breast malignancies had calcifications.

Out of 26 lesions having pleomorphic type of calcification on mammogram, 24 were positive for malignancy, which indicated that pleomorphic type of calcification is one of the criteria in grading a lesion as suspicious for malignancy on

imaging. In a study conducted by Wendie et al. they showed that pleomorphic calcification seen within a mass was mostly proven on histopathology to be a typically invasive ductal carcinoma. [9]

In our study, out of all benign lesion, majority (96.9 %) were wider than taller. Out of all malignant lesions, 36.4 % were wider than taller and 63.6 % were taller than wider. Elverici et al shown that benign lesions constituted 76.9 % of wider than taller lesions while out of all malignant lesions of their study, 54 % were wider than taller and 45 % were taller than wider in their study. [10] Those which were taller than wider were malignant except one. From this we could say that a lesion taller than wider were more likely to be malignant and rest of the lesions could be either benign or malignant.

The most common shape of malignant lesion in mammography and USG was found to be round (44%) while study by Kim SH et al shows most common shape of malignant lesion was irregular. [11]

Out of all benign lesions in our study, well-circumscribed (42.4 %) and lobulated margins (42.4 %) were most common. Out of malignant lesions, well-circumscribed margin had constituted for 6.1 %. In a study by Luciano Chala et al., well-circumscribed margins were found in 78.5 % of all benign lesion and 9.6 % of all malignant lesions, they concluded that well-circumscribed margins, a longitudinal versus AP diameter ratio which was greater than or equal to 1.0 and no hypo echogenicity, with no obvious microcalcifications when seen were most probably considered benign lesion ultrasonography.[12]

All lesions with spiculated margins on mammography, i.e., 13.1 % and ultrasonography, i.e., 19.7 % were found to be positive for malignancy.

Out of 100 patients about 16 patients (16%) had associated axillary lymph node disease. Jong Hoon Lee et al also showed that there were lymph node negative cases more than lymph node positive cases in their study (28.8 % patients had associated axillary lymph node disease).[13]

Positive and negative predictive value, sensitivity and specificity of ultrasonographic and mammographic BI-RADS are compared with Phurailatpam et al as shown in Table 2. [14]

Table-2: Comparison Of Ultrasonography & Mammography BI-RADS With Study By Phurailatpam et al.

Parameters (%)	Our study (Ultrasonography)	Our study (Mammography)	Phurailatpam et al.
Positive predictive value	91.9	91.8	100
Negative predictive value	75	73.52	90.7
Sensitivity	86	86.15	80.7
Specificity	84.8	73.5	100

Moss et al. reported that ultrasonography increased cancer detection by 14% in symptomatic patients who were evaluated with both mammography and ultrasonography. [15] In retrospective study by Georgian et al, out of 293 palpable malignant lesions, ultrasonography detected all cancers; 18 (6.1%) of these 293 cancers were mammographically occult. [16] The specificity and sensitivity were more accurate when ultrasonography was combined with mammography in our study group. Our results were slightly different from other studies which evaluated the sensitivity of radiological grading in predicting malignancy.

It was concluded that combined imaging modalities of ultrasonography and mammography yielded a better result than with either imaging modalities on its own thereby helping in more accurate characterization of lesions in the breast.

CONCLUSION

In younger women, breast ultrasound proves to be more accurate than mammography, especially in those with dense breast tissue. Ultrasound is often superior to mammography in such cases, making it an appropriate initial imaging test. In contrast, the accuracy of mammograms increases in older women with fatty breasts.

By use of concordant mammographic, ultrasonography and FNAC or biopsy results, we could correlate each modality with FNAC or biopsy results and concluded that the most accurate method was when both the modalities were combined to give BI-RADS grading.

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