Section: Radiodiagnosis

Original Research Article

EVALUATION, CORRELATION AND COMPARISON OF ROLE OF DIGITAL MAMMOGRAPHY, ULTRASONOGRAPHY AND MRI IN BREAST IMAGING

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Abstract

Background: Female breast cancer is a complex multi-factorial disease, the etiology of which involves a strong interplay between environmental and genetic factors The aim in breast imaging is to be able to perceive possible abnormality and determine its likelihood of malignancy, thus to make appropriate recommendations to the referring physician. It is of utmost importance to be able to detect breast cancer at the earliest possible stage when it is curable, yet keep unnecessary biopsies to a minimum. This study has been carried out to evaluate, correlate and compare the role of digital mammography, ultrasonography and MRI in breast imaging. **Materials and Methods:** The study consisted of 50 cases presenting with lump breast visiting the OPD or referred to the oncology unit of Command Hospital (EC), a tertiary care hospital from March 2012 to October 2013 , who underwent Digital mammography, Ultrasonography (including colour doppler) and MR mammography . All patients were women and ranged from 35 yrs to 76 years. The diagnostic criteria that were used to classify lesions were based on lesion morphologic features (shape, margins, and internal architecture) and lesion enhancement kinetics (enhancement rate in the early post-contrast phase and signal intensity time course pattern in the intermediate and late post-contrast phase). A BI-RADS category was assigned. All patients were underwent biopsy of the lesion. Informed written consent was obtained. PT, aPTT, HBV and HIV tests for all patients were done. Under aseptic precaution USG guided biopsies of the lesions were done. The specimen slides were sent to the Pathology department of Command Hospital and the reports were collected. **Result:** The sensitivity, specificity, positive and negative predictive values of Digital mammography noted in this study was 80.48%, 88.88%, 97.05% and 50% respectively. The values for ultrasonography was 78.04%, 88.88%, 96.96%, 47.05% and that of MRI was 100%, 88.88%, 97.61%, 100% respectively. The sensitivity, specificity, positive and negative predictive values of study in combined modality was 86.17 %, 88.88%, 97.24 % & 58.53% respectively. The sensitivity of MRI was significantly higher than those of digital mammography or ultrasonography. The specificity of all the modalities were same. The negative predictive values for MRI were significantly higher than those of digital mammography or ultrasonography. The positive predictive values for MRI were slightly higher than Digital mammography & ultrasonography. **Conclusion:** The sensitivity and negative predictive value of MR mammography was significantly higher than those of digital mammography or ultrasonography. The positive predictive value of MRI was slightly higher than those of digital mammography or ultrasonography. The specificity in our study was same for all the modalities. Mammographic sensitivity was found to be lower in radiographically dense breasts. It was found to be the best modality for detecting micro calcifications. Micro-calcifications were most commonly associated with malignant lesions.

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INTRODUCTION

Breast cancer is the second most common cancer in Indian women. Despite this, breast cancer is a curable disease in that, 20 to 30 % of patients diagnosed as having early breast cancer will enjoy a normal life span without further morbidity, following treatment. The high prevalence and need for early treatment of breast malignancy emphasizes the importance of early and accurate diagnosis.[1-4]

It is reported by ICMR that one in 22 women in India is likely to suffer from breast cancer during her lifetime, while problem with preventing breast cancer is that there is no one cause that can be pinpointed as being the culprit. Of course, screening for the presence of BRCA1 and BRCA2 mutations is available though it must be admitted of being of little use in the Indian context. The task of spreading the awareness of the prevalence of this cancer and advising women on undertaking self-breast examination comes very important.[5-8]

Female breast cancer is a complex multi-factorial disease, the etiology of which involves a strong interplay between environmental and genetic factors. Although high penetrance cancer genes, BRCA1 and BRCA2, have been identified, these account for only 5–10% of cases. The others high risk groups are (i) Family history of breast cancer. (ii) Previous personal history of breast cancer and other breast diseases such as fibrocystic disease. (iii) Excessive exposure to ionizing radiation (iv) History of cancer of the endometrium, ovary or colon. Early menarche, late menopause, nulliparity, elderly primi, diminished lactation are also generally associated with breast cancer. An early accurate diagnosis of breast cancer has a favorable prognosis than that of late detection. But more than 90% of the diagnosed cases are in the stage II, III and IV.[9-13]

The aim in breast imaging is to be able to perceive possible abnormality and determine its likelihood of malignancy, thus to make appropriate recommendations to the referring physician. It is of utmost importance to be able to detect breast cancer at the earliest possible stage when it is curable, yet keep unnecessary biopsies to a minimum.[14-17] In order to achieve this, it is necessary that we select the appropriate modality for investigation or a combination of investigations tailored to the patient's age, breast composition, and the clinical problem at hand. Use of the appropriate investigation or combination of investigations thus would not only yield more specific results but would also go a long way in minimizing patient discomfort and cost.[18-20]

With this background, this study has been carried out to evaluate, correlate and compare the role of digital mammography, ultrasonography and MRI in breast imaging.

MATERIALS AND METHODS

The study consisted of 50 cases presenting with lump breast visiting the OPD or referred to the oncology unit of Command Hospital (EC), a tertiary care hospital from March 2012 to October 2013, who underwent Digital mammography, Ultrasonography (including colour doppler) and MR mammography. All patients were women and ranged from 35 yrs to 76 years.

The following factors were recorded from each patient:

- Age of menarche
- Pregnancy
- Menopausal status
- Family history of breast cancer
- Study area: At Department of Radiodiagnosis in Command hospital (EC).

Study Population

Inclusion Criteria

- Woman who are 35 years of age or older, presenting with breast related symptomatology.
- Women above 35 years of age having any of the risk factors of breast carcinoma.

Exclusion Criteria

- Patients unable to undergo diagnostic MR imaging. (Eg. Pacemaker, Metallic prosthesis).
- Non palpable breast lesion
- Post-operative cases.
- Presence of breast haematoma (From either recent Surgery or Biopsy) adjacent to the suspicious lesion.
- Pregnant women, ulcerated and fungating breast lesion
- Moribund patients and proven cases of malignancy.
- Unwilling patients to undergo the study.

Study Period: March 2012 to October 2013

Sample Size: 50 patients or above

Sample Design: Selected patient fulfilling the criteria of study population.

Study Design

a) Prospective study
b) Patients with palpable breast lesions detected on clinical Examination/self-breast examination and referred for mammography will be enrolled in this study. This study was done in Department of Radio diagnosis at Command hospital (Eastern Command).

The patients will be subjected to the following radiological procedure:

A. Mammography:

Digital mammography was done on the NOVATION SIEMENS machine on all patients. Two standard views, craniocaudal & mediolateral oblique views, of each breast was taken. Appropriate exposure factors for breasts of different thickness was selected by the automatically set control panel of machine. KV ranged from 23-25 and mA ranged from 2-400. Breast lesions are depicted on mammogram as one of the four:

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a. Mass
b. Architectural distortion
c. Focal asymmetry
d. Suspicious micro-calcifications

Architectural Distortion

Architectural distortion is seen as numerous straight lines measuring 1-4 mm in length radiating towards a central area. Pathologies presenting as architectural distortion include:

1. Surgical scar
2. Radial scar (Complete sclerosing lesion)
3. Carcinoma

B. Ultrasound with colour doppler breast:

All patients will be subjected to ultrasound breast on Wipro GE Health Care Ultrasound Logic –P5 machine. Breast ultrasound will be performed with high resolution, linear array, and 7.5 to 10 MHz transducers. The main contribution of ultrasonography is the differentiation of simple cysts from solid masses.

Th characteristic findings of benign tumors include a round or oval, slightly hypoechoic lesion with smooth borders or a pseudocapsule, homogeneous internal echoes, no central posterior acoustic shadowing, and normal surrounding tissue.

The typical features of malignancy include irregular shape, irregular margins, hypo-echogenicity, a surrounding echogenic rim or halo, and posterior acoustic shadowing.

Length/ AP ratio: A ratio more than 1.4 is a criteria for benign lesions (wider than taller) while a ratio less than 1.4(taller than wider) favours malignancy. Larger lesions however do not follow this rule.[23]

C. Magnetic Resonance Imaging

MRI mammography will be done using Siemens Magnetom 1 Tesla machine with dedicated breast coils. The coil support apparatus was designed to provide breast immobilization with gentle medial-lateral compression, thereby optimizing coil coupling to each breast. Following sequences will be taken for all patients: T1 Weighted and T2 Weighted axial, coronal and sagittal and STIR sagittal, T2 Fat Saturated coronal and 3 D Flash pre and post-contrast sequences. Gadolinium-DTPA will be given at a dose of 0.1mmol/kg and the uptake of contrast by the lesions will be assessed. The pre-contrast images will be subtracted from the contrast-enhanced images to improve visualization of the enhancing structures.

Two major approaches to image interpretation are there: (a) evaluation of lesion morphology and (b) evaluation of enhancement kinetics following contrast agent administration.

Time Intensity Curve

The curves will be categorized into three patterns as follows:-

- Type I curves (Persistent) are characterized by a gradual increase in enhancement over time and is supportive of a benign lesion.
- Type II curves (Plateau) are characterized by a rise in enhancement intensity followed by a plateau. Can be benign or malignant lesions.
- Type III curves (Wash out) are the 'classic washout curves'; a rapid rise in enhancement followed by a decreased intensity of enhancement, usually indicating malignancy [Figure 1].

The diagnostic criteria that were used to classify lesions were based on lesion morphologic features (shape, margins, and internal architecture) and lesion enhancement kinetics (enhancement rate in the early post-contrast phase and signal intensity time course pattern in the intermediate and late post-contrast phase). A BI-RADS category was assigned [Figure 2 to 5].

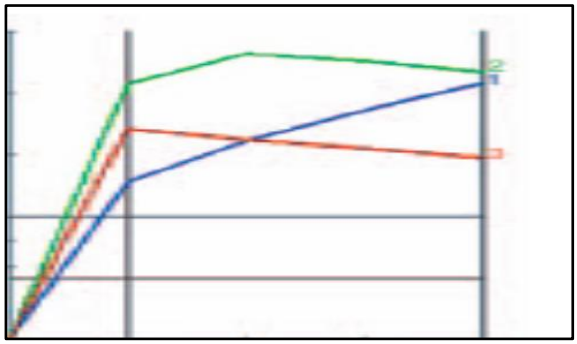

Figure 1: Types of contrast enhancement curve

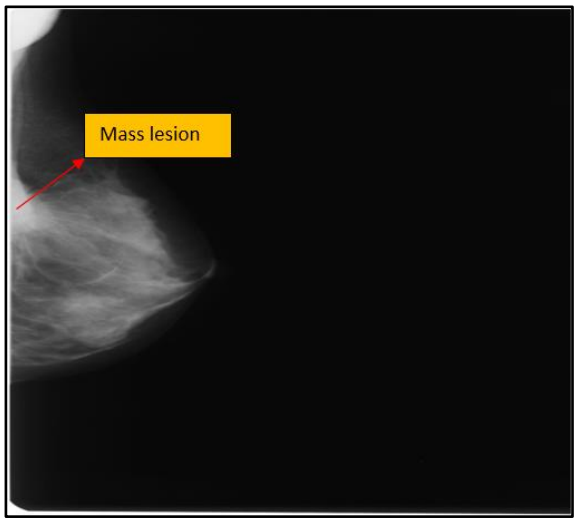

Figure 2: Digital mammography shows a high density lesion with spiculated margins in Supero-medial quadrant of left breast BIRADS IV.

Breast Biopsies

All patients were underwent biopsy of the lesion. Informed written consent was obtained. PT, aPTT, HBV and HIV tests for all patients were done. Under aseptic precaution USG guided biopsies of the lesions were done. The specimen slides were sent to the Pathology department of Command Hospital and the reports were collected.

Statistical Analysis

The category heterogeneity was examined using the two-way analysis of variance (ANOVA) statistical analysis. The significance threshold was established at $P < 0.05$. To determine the degree of significance

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of the differences among each category, the post hoc Bonferroni numerous comparative analysis was used

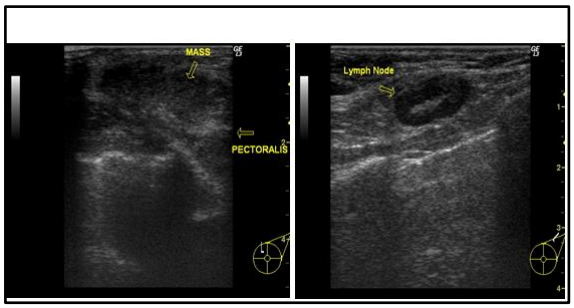

Figure 3: Ultrasonography shows an infiltrating hypoechoeic lesion with lobulated outline and spiculated margins in supero-medial quadrant of left breast. It is abutting and pushing the pectoralis muscle with possible invasion of pectoralis major. Multiple lymph nodes are seen in left axilla largest measuring 1.5 cm in size – BIRADS V

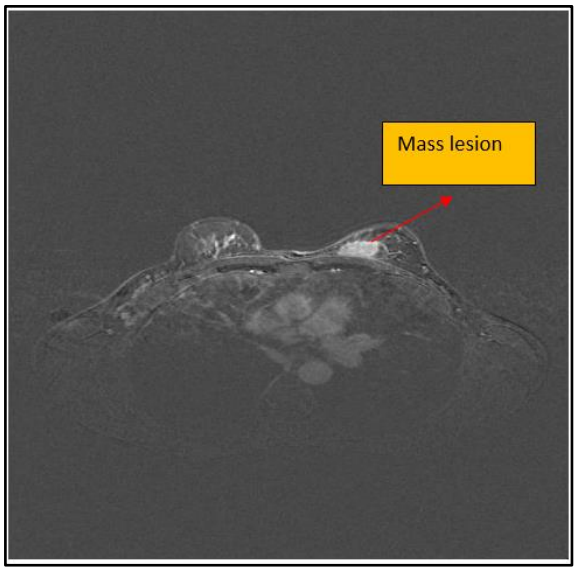

Figure 4: MRI shows a lobulated lesion seen in the supero-medial quadrant of the left breast. The lesion is seen infiltrating into the underlying pectoralis major muscle. Overlying skin is thickened

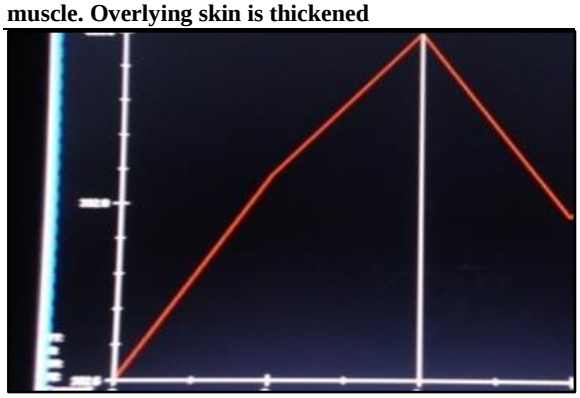

Figure 5: The lesion shows heterogeneous contrast enhancement with early sharp rise with early washout (Type III curve) - BIRADS V

RESULTS

As shown in [Table 1 and Graph 1], the majority of cases were in age group 56 to 65 yrs (40%), 10 (20%) cases were in age group 66 & above, 14 (28%) cases were in age group 45 to 55 yrs & 6 (12%) cases were in age group 35 to 45 yrs. In this study the youngest patient was 35 yrs and the oldest 76yrs. The mean age of patients was 56.24 years [Table 2].

The study included 50 females out of which 40 from Hindu religion, 07 from Muslim and 3 from Christian religion, other religions were nil [Table 3, Graph 2].

As shown in [Table 4 and Graph 3], majority of cases were malignant (82%) with benign pathology seen in 18% of cases. In our study out of 50 patients, 5(10%) had history of hormonal replacement therapy and 6 patients (12%) had history of benign breast disease [Table 5, Graph 4]. 02 (4%) of the patients gave family history of breast cancer and both had first degree relatives with breast cancer. Patients with history of early menarche and late menopause constitute 20% of the study population. Out of 50 women 27(54%) did not have any associated factors.

As shown in [Table 6 and Graph 5], there was a preponderance of carcinoma on the left side of the breast (58.54%) as compared to right side of the breast (41.46 %).

Most common location of malignant tumour was found to be localized in outer upper quadrant in women of both <55 yrs (09 cases) and ≥ 55 yrs (13 cases) of age group. Thus statistically the upper outer quadrant had a significantly higher incidence of tumour involvement compared to the other three quadrants in both groups [Table 7, Graph 6].

USG with Colour Doppler findings of breast lesions:

Total 52 lesions were detected in 50 cases. Multiple (02 lesions) were seen in two cases.

Most benign lesions were wider than taller (L/AP Ratio>1.4) while malignant lesions were taller than wider (L/AP<1.4). This however is applicable to lesions smaller in size; it does not apply to the larger malignant lesions. Most benign lesions were round to oval in shape with smooth or lobulated margins. One benign lesion however had irregular shape. Malignant lesions were found to be irregular in shape and margins with the exception of 12 malignant lesions which were round to oval in shape. Spiculated margin was the feature most consistently associated with malignancy. However one benign lesion was also found to have spiculated margin. Vascularity was seen in 30 lesions, all were malignant [Table 8 (a)].

Most of the malignant lesions had heterogeneous echotexture. Only 07 malignant lesions were hypoechoic in echotexture. Most of the benign lesions were hypoechoic. Only one benign lesion exhibited hyperechoic echotexture [Table 8 (b)].

There was a predominant display of posterior acoustic shadowing by majority of malignant lesions, neither shadowing or enhancement seen in eleven

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malignant lesions, however enhancement was seen in one malignant lesion. Only one of the benign lesions showed posterior acoustic attenuation, three exhibited enhancement and there was no sound transmission in seven benign lesions [Table 8 (b)].

Skin involvement was seen in 4 malignant lesions in the form of skin thickening, induration and puckering. Calcification in the form of posterior shadowing was noted in 6 malignant and 3 benign lesions. Axillary lymphadenopathy associated with carcinomas exhibited malignant infiltration of the nodes with loss of central fatty hilum in 05 malignant lesions [Table 8 (c)].

Digital mammography features of breast lesions:

Majority of the benign lesions had smooth margins (06) and lobulated margins (05). Most of the malignant lesions were found to have spiculated margins; however 06 of the malignant lesions had lobulated margins [Table 9(a)].

Microcalcification was seen in 11 cases, out of which 09 were malignant and 02 were benign. Both micro and macro-calcifications were seen in 02 malignant cases [Table 9(a)].

There was a significant increase in the sensitivity of mammography in non dense breasts as compared to dense breasts [Table 9 (b)].

Architectural distortion was seen to be associated with an irregular mass, which on histopathology was an invasive ductal carcinoma, thus indicating that this distortion was due to invasion into surrounding breast parenchyma. Skin involvement was seen in 03 and nipple retraction in 02 of the malignant cases [Table 9 (c)].

MRI Features of Breast Lesions

Benign lesions were found to have smooth or lobulated margins. Most malignant lesions had spiculated margins; however 10 malignant lesions had lobulated margins. Spiculation was the feature most consistently associated with malignancy. Involvement of skin/ pectoralis was seen in 15 lesions all of which were malignant [Table 10 (a)].

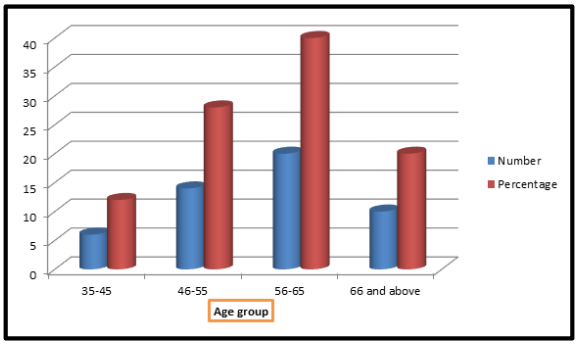
Type I signal intensity curve was seen in 09 benign lesions whereas Type II signal intensity curve was seen in 05 lesions out of which, 04 were malignant and 01 was benign. Type III signal intensity curve was seen in 38 lesions out of which 37 were malignant and 1 was benign {Table 10 (b), Graph 7].

While assessing the accuracy of cancer detection by individual modalities, lesions that were BIRADS I, II and III on that modality were included under 'negative' (for malignancy) and lesions that were BIRADS IV and V on that modality were included under positive (for malignancy) [Table 11].

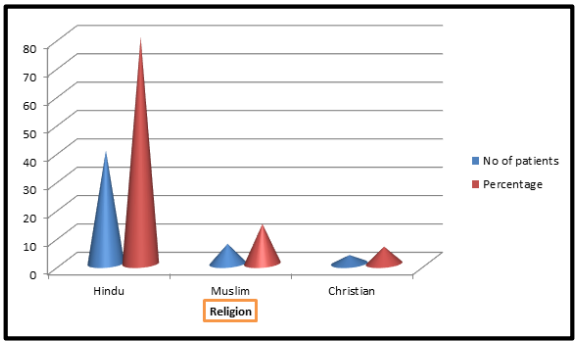
Out of total number of 50 cases, there was concordance of all three imaging modalities with the final histopathological diagnosis in 37 cases as regards to nature of neoplastic lesion [Table 12].

The sensitivity, specificity, positive and negative predictive values of Digital mammography noted in this study was 80.48%, 88.88%, 97.05% and 50% respectively. The values for ultrasonography was 78.04%, 88.88%, 96.96%, 47.05% and that of MRI was 100%, 88.88%, 97.61%, 100% respectively. The sensitivity, specificity, positive and negative predictive values of study in combined modality was 86.17 %, 88.88%, 97.24 % & 58.53% respectively. The sensitivity of MRI was significantly higher than those of digital mammography or ultrasonography. The specificity of all the modalities were same. The negative predictive values for MRI were significantly higher than those of digital mammography or ultrasonography. The positive predictive values for MRI were slightly higher than Digital mammography & ultrasonography.

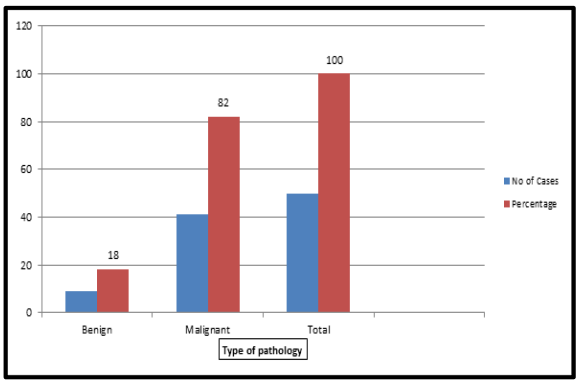
[Table 13].



Graph 1: Number and percentage of patients in different age groups



Graph 2: Ethnic distribution



Graph 3: Distribution of benign and malignant cases

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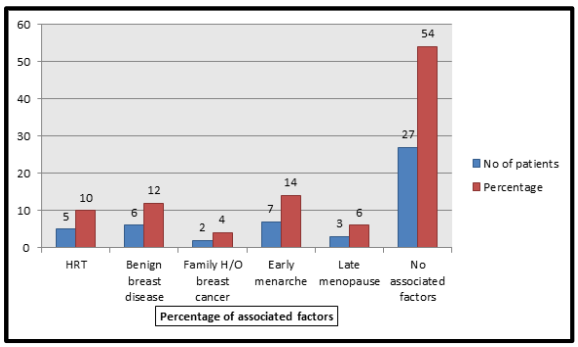
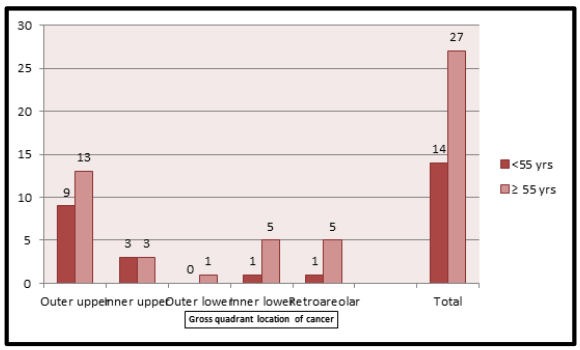
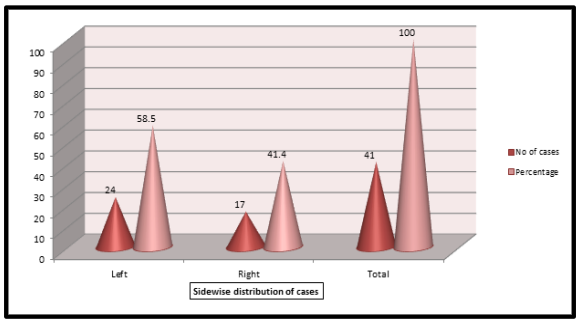


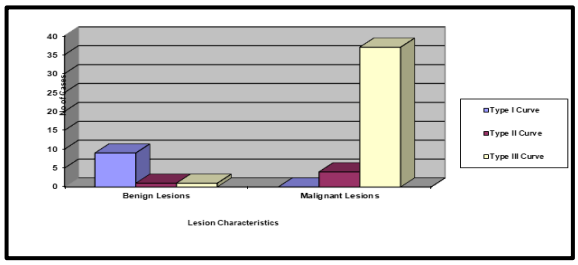
Graph 4: Percentage of associated factors



Graph 6: Gross quadrant location of malignant tumour



Graph 5: Sidewise distribution of cases



Graph 7: Time intensity curve on contrast enhanced MRI

Table 1: Age group wise distribution of cases

Age Group (Years)	Number of cases	Percentage
35-45	06	12%
46-55	14	28%
56-65	20	40%
66 and above	10	20%
Total	50	100%

Table 2: Age distribution of cases

No of cases	Minimum	Maximum	Mean
50	35	76	56.24

Table 3: Ethnic distribution

S no	Religions	No of patients	Percentage
1.	HINDU(H)	40	80%
2.	MUSLIM(M)	07	14%
3.	CHRISTIAN(C)	03	6%
Total		50	100

Table 4: Distribution of benign and malignant cases

Pathology	Number of cases	Percentage
Malignant	41	82%
Benign	09	18%
Total	50	100%

Table 5: Associated factors

S. No	Associated factors	No of patients	Percentage
1.	HRT	5	10%
2.	Benign breast disease	6	12%
3.	Family h/o breast cancer	2	4%
4.	Early menarche	7	14%
5.	Late menopause	3	6%
6.	No risk factors	27	54%

Table 6: Sidewise distribution of cases

Side	No of cases(Malignant)	Percentage
Left	24	58.54 %
Right	17	41.46 %
Total	41	100.0

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Table 7: Gross quadrant location of malignant tumour

QUADRANT	<55yr	≥55yr
Outer Upper	09	13
Inner upper	3	3
Outer lower	0	1
Inner lower	1	5
Retroareolar	1	5
Total	14	27

Table 8 (a): Size, shape, margin& vascularity assessment of mass lesion

USG features		No of lesions	Benign	Malignant
Size	L/AP> 1.4	25	10	15
	L/AP<1.4	27	1	26
Shape	Round	12	5	7
	Oval	10	5	5
	Irregular	30	1	29
Margins	Smooth	5	5	0
	Lobulated	17	5	12
	Spiculated	30	1	29
Vascularity	Vascular	30	0	30(RI>0.8)
	Avascular	22	11	11

Table 8 (b): Echotexture and posterior transmission:

USG features		No of lesions	Benign	Malignant
Echogenecity	Hypoechoic	17	10	7
	Hyperechoic	1	1	0
	Heteroechoic	34	0	34
Posterior sound transmission	Attenuation	30	1	29
	Enhancement	4	3	1
	No change	18	7	11

Table 8 (c): Other associated findings

USG features	No of lesions	Benign	Malignant
Skin Thickening/Invasion of pectoralis	4	0	4
Calcification	9	3	6
Axillary lymphadenopathy (with loss of central fatty hilum)	5	0	5

Table 9 (a): Assessment of margins and calcification

Digital mammographic features		No of lesions	Benign	Malignant
Margins	Smooth	10	6	4
	Lobulated	11	5	6
	Spiculated	31	0	31
Calcifications	Micro	11	2	9
	Macro	7	3	4
	Mixed	2	0	2

Table 9 (b): Effect of breast density on sensitivity of Digital mammography

Digital mammographic density	True positive	False positive	True negative	False negative	Sensitivity
Dense breasts>25% glandular)	11	1	06	05	68.75%
Non dense breasts(<25% glandular)	22	00	03	02	91.66%

Table 9 (c): Other associated findings

Digital mammographic features	No of lesions	Benign	Malignant
Architectural distortion	1	0	1
Skin involvement	3	0	3
Pectoralis involvement	0	0	0
Nipple retraction	2	0	2

Table 10 (a): Assessment of margins, skin involvement and pectoralis invasion

MRI features		No of lesions	Benign	Malignant
Margins	Smooth	4	4	0
	Lobulated	17	7	10
	Spiculated	31	0	31
Skin thickening / Pectoralis invasion		15	0	15

Table 10 (b): Time intensity curve on contrast enhanced MRI

Type of time intensity curve	Number	Benign	Malignant
Type I	9	9	0
Type II	5	1	4
Type III	38	1	37

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Table 11: Accuracy of cancer detection cases by imaging modalities used

Modality	True positive	False positive	True negative	False negative
Ultrasonography	32	1	8	9
Digital mammography	33	1	8	8
MRI	41	1	8	0

Table 12: Concordance of all three modalities with the final histopathological diagnosis

Cases positive for malignancy by all three modalities	30
Cases negative for malignancy by all three modalities	07
Total	37

Table 13: Performance characteristics of each screening modality

Modality	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Ultrasonography	78.04%	88.88%	96.96%	47.05%
Digital mammography	80.48%	88.88%	97.05%	50%
MRI	100%	88.88%	97.61%	100%
Combined	86.17 %	88.88 %	97.24%	58.53%

DISCUSSION

This prospective study was carried out on a total of fifty female patients referred to the oncology unit of a tertiary care hospital makes an attempt to compare and contrast the accuracy of evaluation of the breast lesions by USG, digital mammography and MRI.

It studies the imaging features of palpable breast lesions on all modalities as well as their histopathological correlations.

It tries to assess the risk benefit ratio of each modality so that maximum diagnostic yield can be achieved by choosing the appropriate modality tailored for each case.

In our study, ranges of age of the patients were 35 years to 76 years. The mean age of our study was 56.24 yrs and the commonest age group of patients was 56 years to 65 years. In a study by Jonathan I. Wiener, Kathy J.Schilling, Carol Adami and Nancy A20 to assess the incremental value of contrast-enhanced MRI in the diagnosis and treatment planning using both a three–time point kinetic and morphologic analysis in addition to mammography and sonography in patients thought to have early-stage breast cancer. The age of the patients were 30-82, mean age was 56.6 years; Mean age of our study was in consensus with the findings of the authors as mentioned above.

In our study, there was a slight preponderance of left sided carcinoma as compared to right side (58.54 % on left and 41.46 % on right). These findings are consistent with those of Fisher et al,[21] whose study also had a slight left sided preponderance (51.4% and 48.6% respectively).

The location of cancer according to quadrants in patients younger than 55yrs and in those 55yrs and older in our study was similar to the distribution in series of Tellum et al.[22] Most studies have shown the upper outer quadrant has a greater risk of cancer than the other quadrants.

Ultrasonography proved to be the modality used to measure mass lesions, so as to obtain maximum accuracy. This in accordance to the observations of Fornage et al,[23] who have shown that real time Ultrasonography as compared with physical examination or mammography yields the most accurate pre-operative determination of breast cancer size.

The combination of physical examination with either mammography or Ultrasonography significantly improves the accuracy of non invasive assessment of tumour dimensions.[24] In our study most malignant lesions were taller than wider. This in accordance to the observations of Fornage et al.[25]

In our study most benign lesions showed round-oval shape with smooth or lobulated margins with posterior acoustic enhancement. Most malignant lesions were irregular in shape and margins, heteroechoic with posterior acoustic shadowing. This was in accordance with studies done earlier by Vlaisavljevic and Tzu-Chieh Chao.[24,25]

Mammographic sensitivity is lower in radiographically dense breasts. Mammographic sensitivity was found to be 91.66% in non-dense breasts and only 68.75% in dense breasts. These findings are similar to various other studies. Rosenberg et al,[26] found that in all age groups, women with dense breasts had a lower mammographic sensitivity than those with fatty breasts. The sensitivity of mammography to the index cancer ranges from 63% to 98%,[18] and has been reported to be as low as 30%-48% in dense breasts.[19]

In our study micro-calcifications were most commonly associated with malignant lesions. The commonest pattern was of clustered pleomorphic or branching and linear pattern. Mammography was found to be the best modality for detecting micro calcifications. This was in accordance with other studies.

In our study on MRI most malignant lesions showed either spiculated (31 lesions) or lobulated (10 lesions) margins. 37 malignant lesions showed type III SI curve and 4 showed type II curve. Most benign lesions showed smooth/lobulated margins with type I SI curve. This was in accordance with previous study done by Kinkel K et al.[27]

In our study, majority of malignant lesions, 30 out of 41 malignant lesions shows vascularity. All the

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benign lesions were avascular. This was in accordance with other studies.

In our study there was discordance in the results among all three modalities in 13 cases. Out of these 11 cases were found as malignant on histopathology. All the 11 malignant cases were diagnosed correctly by MRI; however, 5 out of 11 were considered low risk for malignancy by both mammography and sonography. 8 out of the 11 cases were considered low risk for malignancy on mammography only & 9 out of 11 cases were considered low risk for malignancy on Ultrasonography only. Two cases were found as benign on histopathology. One was considered as high risk for malignancy on mammography as it showed clustered micro-calcifications. However it was not visualized on Ultrasonography and MRI and biopsy from that site was found benign. One was considered as high risk for malignancy on ultrasonography & MRI as it showed spiculated margin, taller than wide on USG & showed lobulated margin with heterogeneous enhancement on MRI. However the lesion was well defined with lobulated margin & macro-calcification on mammography & considered as benign and biopsy from that site was found benign.

The sensitivity, specificity, positive and negative predictive values of Digital mammography noted in this study was 80.48%, 88.88%, 97.05% and 50% respectively. The values for ultrasonography 78.04%, 88.88%, 96.96%, 47.05% and that of MRI was 100%, 88.88%, 97.61%, 100% respectively. The sensitivity, specificity, positive and negative predictive values of study in combined modality was 86.17 %, 88.88%, 97.24 % & 58.53% respectively. The sensitivity of MR mammography was significantly higher than those of mammography or ultrasonography. This was in accordance with study done by Huang W, Fisher PR, Dulaimy K, Tudorica LA, O'Hea B, Button TM.[28] The negative predictive values& sensitivity for MR were significantly higher than mammogram and ultrasonography. This was in accordance with study done by Sabine Malur et al and Berg WA et al.[29,30] The specificity of all the modalities were same in our study. The positive predictive value of MR mammography was slightly higher than those of mammography or ultrasonography.

CONCLUSION

The sensitivity and negative predictive value of MR mammography was significantly higher than those of digital mammography or ultrasonography. The positive predictive value of MRI was slightly higher than those of digital mammography or ultrasonography. The specificity in our study was same for all the modalities. Mammographic sensitivity was found to be lower in radiographically dense breasts. It was found to be the best modality for detecting micro calcifications. Micro-calcifications were most commonly associated with malignant lesions.

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