



## CORRELATION OF MAMMOGRAPHY WITH MAGNETIC RESONANCE IMAGING IN EVALUATION OF BREAST PATHOLOGIES.

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### ABSTRACT

Breast cancer has ranked number one cancer among Indian females with age adjusted rate as high as 25.8 per 100,000 women and mortality 12.7 per 100,000 women. Mortality to incidence ratio was found to be as high as 66 in rural registries whereas as low as 8 in urban registries. Besides this young age has been found as a major risk factor for breast cancer in Indian women. Breast cancer projection for India during time periods 2020 suggests the number to go as high as 1797900. Better health awareness and availability of breast cancer screening programmes and treatment facilities would cause a favorable and positive clinical picture in the country. This increases the responsibility of the radiologist to accurately and timely screen and diagnose breast malignancy and various other pathologies. Various modalities are available for the evaluation of the breast pathologies and screening of breast cancer like- Conventional and Digital X ray Mammography Tomo-mammography Sono-mammography and MR mammography. Magnetic resonance imaging is non-ionizing, avoids harmful radiation to the lens. Excellent soft tissue details and multi-planar imaging is feasible. Bony artifacts are not seen and vessels can be identified by the contained flow void. In our present study, we have evaluated 32 patients with breast pathologies. An attempt has been made to devise an optimum imaging protocol in a given group of disorders. It also compares the reliability of Magnetic Resonance Imaging and X ray Mammography in diagnosis by comparing it with histopathological diagnosis.

### KEYWORDS :

#### AIMS AND OBJECTIVES

1. To characterize various breast lesions using different MRI sequences.
2. To differentiate breast lesions into benign and malignant based on their contrast enhancement curves.
3. To evaluate the accuracy and efficiency of MRI in evaluating breast pathologies in comparison to mammography.

#### MATERIALS AND METHODS

- **Institution**- Government medical college and Hospital, Nagpur
- **Duration of Study**-2.0 years
- **Source of cases**-Patients referred from Surgery ,Oncology (radiotherapy departments).
- **Sample size** - 32 patients

#### Inclusion Criteria-

1. Patients with lump / pain in breast.
2. Female with nipple discharge/nipple retraction.
3. High risk patients for screening

#### Exclusion criteria-

1. Patients with MRI incompatible device like pacemaker ,aneurysmal clips,
2. Orthopedic implants etc.
3. Claustrophobic patients.
4. Patients lost to follow up.
5. Pregnant and lactating women.

**Instrumentation**- MR Imaging was done on a 1.5 Tesla, MR Achieva, Phillips. A standard head coil was used for the examination.

#### Patient Preparation:

- No specific preparation was required before the scans.
- Few uncooperative patients were sedated for MRI before the examination.
- All the patients were given instructions to remove all metallic belongings prior to the examination



#### Protocol For The Mammography Breast

- **Cranio-caudal view-**
  - a) It is used for the medial aspect of the breast. X-ray tube is kept at 90°.
  - b) Patient is facing straight, head turned away.
  - c) Technician stands at medial aspect.
  - d) The breast is positioned in a Sandwich technique.

- **Medio-lateral Oblique view-**

- a. It is taken from the middle of the chest, out to side of the body with the x-ray tube at an angle. This is the only view in which maximum amount of breast tissue is visualized.
- b. Positioning: Cassette holder parallel to pectoralis muscle in axilla.
- c. 40°- 60° tube angulations.
- d. Steep angle is use for tall slim females. Lesser angle is used for short heavy females.
- e. Patient faces the unit straight with arm resting over and on to the back of the cassette holder.
- f. Elbow flexed and hand on bar. Shoulders pushed down

#### Protocol for the MR breast

**Patient Positioning:** Prone ,with both breast hanging freely in the coil aperture.

**Topogram Position / Landmark:** Centre of coil , middle of breast.

**Pulse sequences:**

1. T1W-TSE (Turbo Spin echo)
2. T1W-FAT SAT Axial
3. T2W-TSE Axial
4. T2W-SPAIR Axial
5. T2W-TSE COR,
6. DWI(Diffusion weighted imaging) Dyn-THRIVE-C Axial
7. T1W-CONTRAST TRA ,COR,SAG

Dynamic contrast enhanced MRI was performed on all 32 Patients on a Philips Achieva 1.5 Tesla MR System .

**Slice Thickness:** 3mm

**Contrast Administration :** Intravenous

**Scan Time :** 30 min.

Sono-mammography of the patient was done followed by MRI.

The morphology of the lesion , its T1,T2 characteristics, diffusion restriction and type of enhancement and kinetic enhancement curves were assessed and Reporting was done according to the ACR BIRADS lexicon.

The patients underwent FNAC following MRI . They were followed up with the cytological reports which were correlated with the MRI diagnosis .

**OBSERVATIONS AND RESULTS**

**GENDER DISTRIBUTION**

| Gender       | No. of patients | Percentage  |
|--------------|-----------------|-------------|
| Female       | 31              | 96.8%       |
| Male         | 1               | 3.2%        |
| <b>Total</b> | <b>32</b>       | <b>100%</b> |

**AGE DISTRIBUTION**

| Age in years | Number of patients | Percentage  |
|--------------|--------------------|-------------|
| ≤20          | 1                  | 3.1%        |
| 21-30        | 2                  | 6.2 %       |
| 31-40        | 7                  | 21.8%       |
| 41-50        | 12                 | 37.5%       |
| 51-60        | 8                  | 25.0%       |
| >60          | 2                  | 6.2%        |
| <b>Total</b> | <b>32</b>          | <b>100%</b> |

**CLINICAL PRESENTATION**

| Chief complaint       | Number of patients | Percentage    |
|-----------------------|--------------------|---------------|
| <b>Lump in breast</b> | <b>22</b>          | <b>68.70%</b> |

**TYPE OF MASS-LIKE ENHANCEMENT**

| Sr.No. | Pathology                   | No enhancement | Homogeneous with /without nonenhancing internal septations | Heterogeneous with or without enhancing internal septations | Rim      | Total     |
|--------|-----------------------------|----------------|--|---|----------|-----------|
| 1.     | <b>Malignant</b>            | -              | 3 (20%)  | 12( 80%)  | -        | 15 (100%) |
| 2.     | <b>Fibroadenoma</b>         | -              | 3(60%)   | 2(40%)  | -        | 5(100%)   |
| 3.     | <b>Fibrocystic disease</b>  | -              | -  | 3(100%)   | -        | 3 (100%)  |
| 4.     | <b>Phyllodes tumor</b>      | -              | -  | 1(100%)   | -        | 1(100%)   |
| 5.     | <b>Lipoma</b>               | 1(100%)        | -  | -   | -        | 1(100%)   |
| 6.     | <b>Abscess</b>              | -              | -  | 1(25%)  | 3(75%)   | 4(100%)   |
| 7.     | <b>Granulomatous lesion</b> | -              | -  | 2(66.6%)  | 1(33.3%) | 3(100%)   |
|        | <b>Total</b>                |                |  |   |          |           |

**TYPE OF ENHANCEMENT CURVE IN BREAST LESIONS**

| Type of enhancement curve   | Type 1  | Type 2    | Type 3     | Total     |
|-----------------------------|---------|-----------|------------|-----------|
| <b>Malignant lesion</b>     | -       | 3 (20.0%) | 12 (80.0%) | 15 (100%) |
| <b>Fibroadenoma</b>         | 3 (75%) | 1 (25%)   | -          | 4         |
| <b>Phyllodes tumor</b>      | -       | 1         | -          | 1         |
| <b>Fibrocystic disease.</b> | 1       |           | -          | 3         |
| <b>Lipoma</b>               | 1       |           | -          | 1         |
| <b>Abscess</b>              | 3       | 1         | -          | 4         |
| <b>Granulomatous Lesion</b> | 2       | 1         | -          | 3         |

|                         |    |        |
|-------------------------|----|--------|
| <b>Nipple discharge</b> | 10 | 31.20% |
| <b>Pain in breast</b>   | 15 | 46.80% |

**VARIOUS PATHOLOGIES IN OUR STUDY**

| Sr.No | Pathology                   | No of patients | Percentage  |
|-------|-----------------------------|----------------|-------------|
| 1     | <b>Neoplastic –Benign</b>   | 10             | 31.2%       |
| 2     | <b>Malignant</b>            | 15             | 46.8%       |
| 3     | <b>Abscess</b>              | 4              | 12.5%       |
| 4     | <b>Granulomatous lesion</b> | 3              | 9.3%        |
|       | <b>Total</b>                | <b>32</b>      | <b>100%</b> |

**LATERALITY AND LOCATION OF MALIGNANT TUMOR IN BREAST**

| Sr. No | Laterality             | No of cases | % of cases  |
|--------|------------------------|-------------|-------------|
| 1.     | <b>Left</b>            | 6           | 40.0%       |
| 2.     | <b>Right</b>           | 8           | 53.0%       |
| 3.     | <b>Bilateral</b>       | 1           | 7.0%        |
|        | <b>Total Malignant</b> | <b>15</b>   | <b>100%</b> |

| Sr. No       | Location (Quadrant)           | No of patients | Percentage  |
|--------------|-------------------------------|----------------|-------------|
| 1            | <b>Central</b>                | 2              | 13.3%       |
| 2            | <b>Upper outer</b>            | 6              | 40.2%       |
| 3            | <b>Lower outer</b>            | 3              | 20.0%       |
| 4            | <b>Upper inner</b>            | 1              | 6.6%        |
| 5            | <b>Lower inner</b>            | 1              | 6.6%        |
| 6            | <b>More than one quadrant</b> | 2              | 13.3%       |
| <b>Total</b> |                               | <b>15</b>      | <b>100%</b> |

**DETECTION ON FNAC AND HISTOPATHOLOGY**

| Sr. No | Pathology                   | FNAC positive | FNAC negative , indeterminate | Total |
|--------|-----------------------------|---------------|-------------------------------|-------|
| 1.     | <b>Malignant</b>            | 13            | 2                             | 15    |
| 2.     | <b>Fibroadenoma</b>         | 5             | -                             | 5     |
| 3.     | <b>Fibrocystic disease</b>  | 1             | 2                             | 3     |
| 4.     | <b>Phyllodes tumor</b>      | 1             | 0                             | 1     |
| 5.     | <b>Lipoma</b>               | 1             | 0                             | 1     |
| 6.     | <b>Abscess</b>              | 4             | 0                             | 4     |
| 7.     | <b>Granulomatous lesion</b> | 1             | 2                             | 3     |

**MRI ENHANCEMENT TYPE**

| Sr.No.       | Type                  | No. of cases | % of cases  |
|--------------|-----------------------|--------------|-------------|
| 1.           | <b>No Enhancement</b> | 10           | 31.2        |
| 2.           | <b>Mass Like</b>      | 14           | 43.7        |
| 3.           | <b>Non Mass Like</b>  | 8            | 25.1        |
| <b>Total</b> |                       | <b>32</b>    | <b>100%</b> |

**DIFFUSION RESTRICTION IN VARIOUS BREAST LESIONS**

| Pathology            | Diffusion restriction present | Diffusion restriction absent | Total |
|----------------------|-------------------------------|------------------------------|-------|
| Malignant            | 11( 73.3 %)                   | 4( 26.6%)                    | 15    |
| Fibroadenoma         | -                             | 5                            | 5     |
| Fibrocystic disease  | 1                             | 2                            | 3     |
| Phyllodes tumor      | 1                             | -                            | 1     |
| Lipoma               | -                             | 1                            | 1     |
| Abscess              | 4                             | -                            | 4     |
| Granulomatous lesion | 1                             | 2                            | 3     |

**MAMMOGRAPHIC FINDINGS OF VARIOUS BREAST LESIONS.**

| Pathology           | Margins                          |   | Asymmetry | Architectural distortion | Calcifications |                    | Total     |
|---------------------|----------------------------------|---|-----------|--------------------------|----------------|--------------------|-----------|
|                     | Benign (Circumscribed obscured.) | Malignant (Microlobulated, Indistinct, Spiculated ) |           |                          | Benign pattern | Aggressive pattern |           |
| Malignant           | 1                                | 10  | 8         | 11                       | 3              | 12                 | 15 (100%) |
| Fibroadenoma        | 4                                | 1   | 1         | -                        | 5              | -                  | 5(100%)   |
| Fibrocystic disease | 3                                | -   | -         | -                        | -              | -                  | 3 (100%)  |
| Phyllodes tumor     | -                                | -   | -         | 1                        | -              | 1                  | 1(100%)   |
| Lipoma              | 1                                | -   | -         | -                        | -              | -                  | 1 (100%)  |
| Abscess             | 4                                | -   | -         | -                        | -              | -                  | 4(100%)   |

**ASSOCIATION OF MAMMOGRAPHY DIAGNOSIS (BIRADS CATEGORY) WITH CYTOLOGICAL DIAGNOSIS**

| Mammography Diagnosis(birads) | FNAC/HPE                |                         | Total |
|-------------------------------|-------------------------|-------------------------|-------|
|                               | Positive for malignancy | Negative for malignancy |       |
| I                             | -                       | -                       | 3     |
| II                            | -                       | 7                       | 7     |
| III                           | 2                       | 6                       | 8     |
| IV                            | 4                       | 2                       | 6     |
| V                             | 5                       | 1                       | 6     |
| VI                            | 2                       | -                       | 2     |
| Total                         |                         |                         | 32    |

|       |   |   |    |
|-------|---|---|----|
| II    | - | 6 | 6  |
| III   | - | 6 | 6  |
| IV    | 6 | 1 | 7  |
| V     | 8 | - | 8  |
| VI    | 2 | - | 2  |
| Total |   |   | 32 |

**RATE OF LESION CLASSIFICATION AS BENIGN OR MALIGNANT**

|             | ACR BIRADS 1-3 (CORRECT DIAGNOSIS) | ACR BIRADS 4-5 (OVERDIAGNOSIS) |
|-------------|------------------------------------|--------------------------------|
| MAMMOGRAPHY | 48%                                | 40%                            |
| MRI         | 65%                                | 35%                            |

**ASSOCIATION OF MRI DIAGNOSIS (BIRADS CATEGORY) WITH CYTOLOGICAL DIAGNOSIS**

| MRI Diagnosis (BIRADS) | FNAC/HPE                |                         | Total |
|------------------------|-------------------------|-------------------------|-------|
|                        | Positive for malignancy | Negative for malignancy |       |
| I                      | -                       | -                       | 3     |

**PATHOLOGY RESULT VERSUS IN 32 PATIENTS**

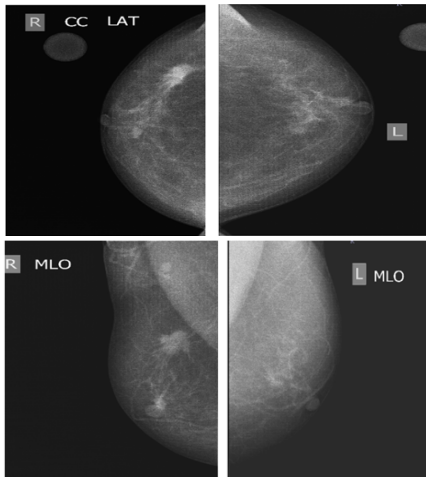
|               | MAMMOGRAPHY | MRI |
|---------------|-------------|-----|
| UNDERESTIMATE | 17          | 7   |
| EQUAL         | 6           | 23  |
| OVERESTIMATE  | 9           | 2   |

**COMPARISON STATS**

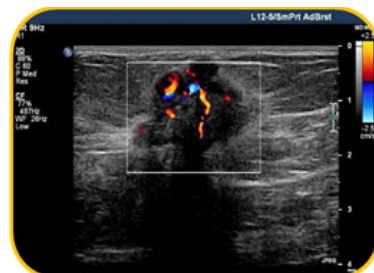
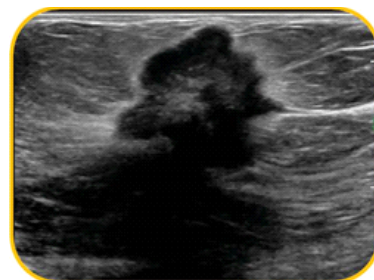
| PERFORMANCE CHARACTERISTICS OF SCREENING MODALITIES |               |                  |                  |             |      |             |      |
|---|---------------|------------------|------------------|-------------|------|-------------|------|
| MODALITY  | TOTAL SCREENS | ABNORMAL SCREENS | CANCERS DETECTED | SENSITIVITY | PPV  | SPECIFICITY | NPV  |
| MAMMOGRAPHY   | 32            | 21               | 8                | 33          | 66 % | 99%         | 97%  |
| MRI   | 32            | 22               | 15               | 100         | 26%  | 91%         | 100% |

**SOME INTERESTING IMAGES AND CASES**

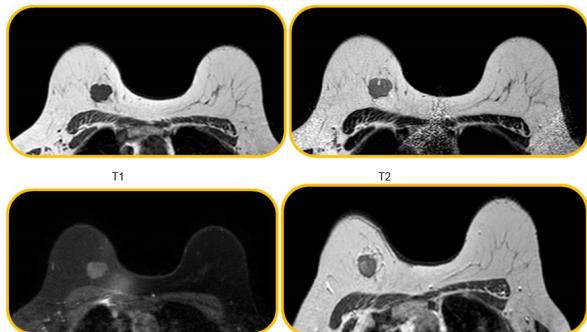
Case 1) 66 year old female came with c/o painless lump in right breast.



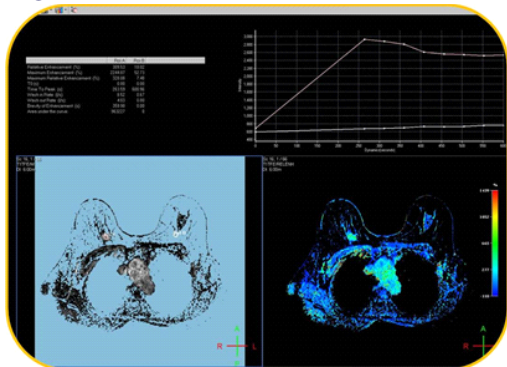
Mammography Revealed A Irregular Lesion With Spiculated Margins In Upper Outer Quadrant Of Right Breast



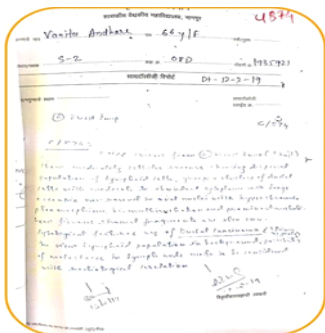
Usg Revealed Relatively Well Defined Lobulated Lesion Showing Vascularity And Post Acoustic Shadow



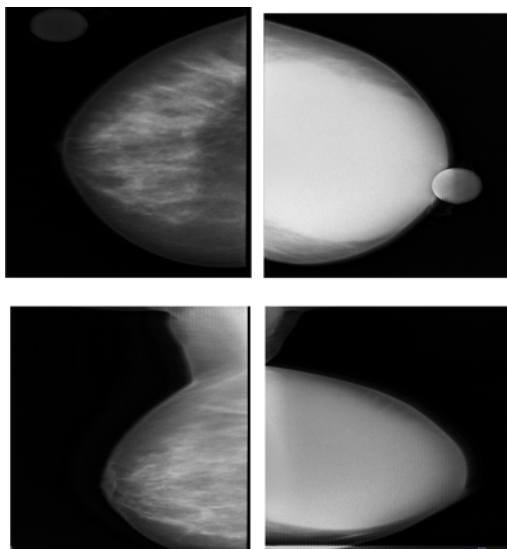
Mri Revealed A Relatively Well Defined Lobulated Lesion Appearing Hypointense On T1, Hyperintense On T2/stir And Showing Post Contrast Enhancement.



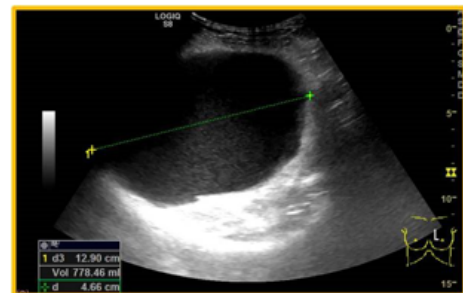
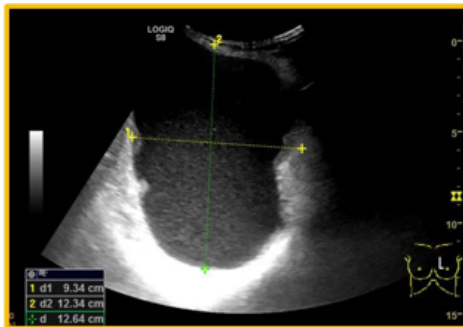
On Dynamic Contrasts Imaging The Lesion Showed A Type II Kinetic Enhancement Curve.



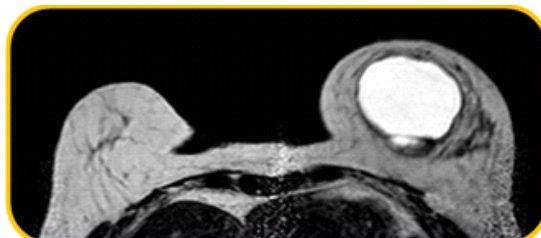
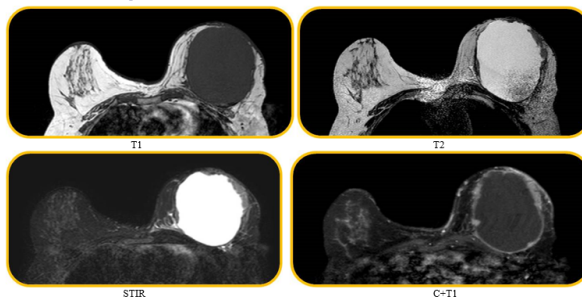
On Histopathology The Lesion Was Found To Be Ductal Carcinoma In Situ



Mammography Revealed A Homogenous Radiodense Lesion Involving The Entire Left Breast

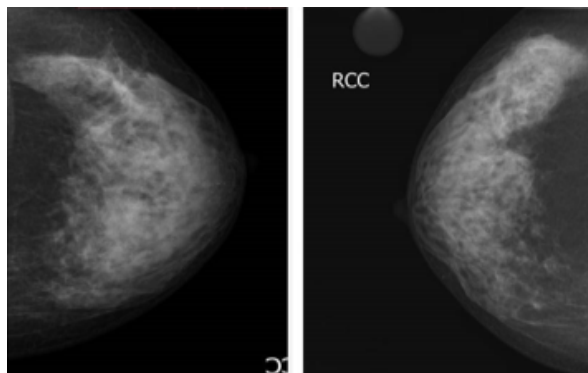


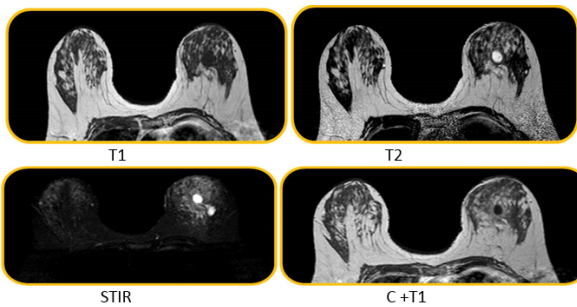
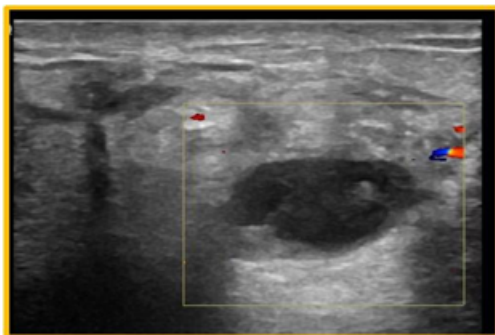
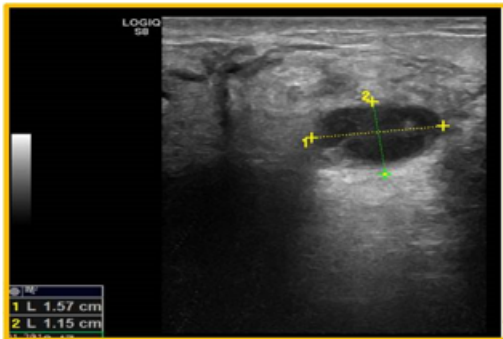
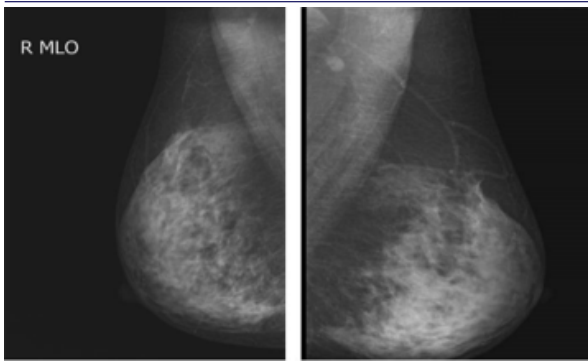
Usg Revealed Relatively Well Defined Cystic Lesion With Solid Nodular Component In Its Wall



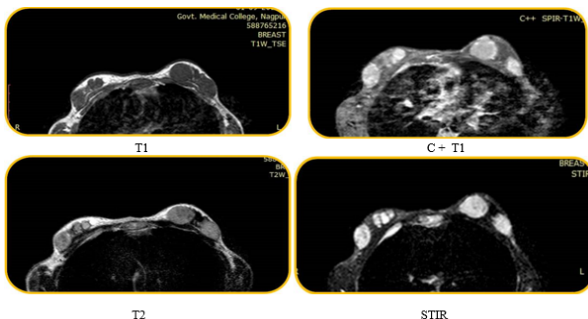
Mri Revealed A Relatively Well Defined Round To Oval Lesion Hypointense On T1, Hyperintense On T2/stir And Showing Peripheral Post Contrast Enhancement. Few Septations Were Noted Within. On Histopathology The Diagnosis Was Found To Be Proliferative Disease With Atypia.

Case 3 ) 51 year old female came with c/o painless lump in left breast.





Mri Revealed Fewrelatively Well Defined Round To Oval Lesions Appearing Hypointense On T1, Hyperintense On T2/stir And Showing Peripheral Post Contrast Enhancement. Few Septations Were Noted Within. On Histopathology The Diagnosis Was Found To Be Fibrocystic Disease Of Breast.



MRI Revealed Multiple Relatively Well Defined Round To Oval Lesions In Bilateral Breast Parenchyma Appearing Hypointense On T1, Hyperintense On T2/stir And Showing Intense Post Contrast Enhancement. Few Septations Were Noted Within. Lesions Show Relatively Increased Perfusion On Dynamic Contrast Studies As Compared To The Surrounding Normal Breast Parenchyma. On Interpolation Of The Kinetic Curves Following Contrast Infusion, Type Ii To Type Iii Curves Were Noted In All Of The Lesions Suggesting Early Contrast Enhancement And Washout. Opinion Was Given To Be Lesions Of Malignant Neoplastic Etiology. On Immunohistochemistry, The Lesions Were Found To Be Consistent With Metastaic Retinoblastoima Deposits.

**DISCUSSION**

1. Tumor size is also more accurately depicted with MRI vs. mammography when correlated with pathologic specimens as stated by the study conducted by Warner et al.
2. In the present study , MRI was able to correctly diagnose 65% cases as opposed to 48 % on mammography.
3. Breast MRI should be used as a complementary study to Mammography .
4. Dynamic contrast-enhanced breast MRI (DCE-MRI) includes a multi-phase T1-weighted series of pre-contrast images, early-phase post-contrast images and delayed-phase post- contrast images. The analysis of contrast uptake allows MRI to assess kinetic characteristics of lesions, in addition to morphology.
5. Breast MRI is also better at monitoring the response to chemotherapy than other imaging modalities used today.
6. Breast MRI should not be used instead of mammography; it is a complementary study to other breast imaging modalities.

**SUMMARY**

1. Breast mri is a valuable imaging tool in addition to mammography and ultrasound, which allows the identification of otherwise occult breast disease. it is particularly useful in the evaluation of patients with breast cancer and for screening women at high risk of breast cancer. the indications for the performance of breast mri outlined in the acr practice guidelines have been reviewed. due to its high cost and limited specificity, it is imperative that breast mri be used judiciously in accordance with these guidelines.
2. Most of the patients in our study were females in 41-50 years age group, which clearly
3. Depicts the change in the trends of breast cancer incidence occurring at earlier age.
4. In our study most common pathology was the benign tumors like fibroadenoma .malignant
5. Breast tumors of the breast were the second most common pathology.
6. Most of the malignant tumors showed mass like enhancement ,with heterogonous enhancement being the commonest one.
7. Most common type enhancement curve in the malignant tumors was the type 3 curve.
8. Fibroadenoma shows type 1 curve in majority of the cases.
9. Non mass like enhancement was seen in cases of ductal carcinoma in situ.

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