

Research Article

The Study of MRI Findings in Breast Lumps as an Adjunct to Histopathological Characteristics and Clinical examination

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Abstract: Introduction: Breast lumps are a common issue that need careful assessment to tell apart benign from malignant growths. Clinical exams and regular imaging are still important, but magnetic resonance imaging (MRI) provides better details of soft tissue and functional evaluation. This study looked at how MRI can help in examining breast lumps alongside clinical examination and tissue diagnosis. **Objectives:** To assess MRI findings in patients with breast lumps and determine their correlation with clinical features and histopathological outcomes. **Methods:** The study was conducted at a tertiary care teaching hospital over a period of 2 years on 64 patients presenting with breast lumps. All patients underwent detailed clinical examination, ultrasonography, breast MRI, and histopathological evaluation. MRI findings were analyzed using BI-RADS classification, lesion morphology, contrast enhancement kinetics, and diffusion-weighted imaging (DWI). Correlations between MRI characteristics and histopathological diagnosis were assessed. **Results:** The mean age of participants was 40.6 ± 13.98 years, with the highest proportion belonging to the 41–50-year age group. Benign lesions constituted 62.5% of cases, whereas malignant lesions accounted for 37.5%. MRI BI-RADS categories II and III were exclusively associated with benign lesions, while categories IV and V corresponded entirely to malignant lesions ($p < 0.001$). Benign lesions predominantly demonstrated well-defined margins, lobulated morphology, and persistent enhancement patterns. Malignant lesions were characterized by irregular or spiculated margins, washout enhancement kinetics, and diffusion restriction on DWI. A strong correlation was observed between MRI findings and histopathological diagnosis, indicating excellent diagnostic performance. **Conclusion:** Breast MRI is a highly effective adjunctive imaging modality for the evaluation of breast lumps. Its ability to accurately characterize lesions and predict malignancy significantly enhances diagnostic confidence and complements histopathological assessment, thereby facilitating appropriate clinical management and treatment planning.

Keywords: Breast Lumps, Histopathological outcomes, MRI, Malignancy, Breast lesion.

INTRODUCTION

Breast diseases constitute a significant proportion of surgical and radiological workload worldwide, with breast lumps being one of the most common clinical presentations in women across all age groups. Early and accurate characterization of breast lumps is therefore critical for timely diagnosis, appropriate management, and improved patient survival outcomes.[1]

Magnetic Resonance Imaging (MRI) of the breast has emerged as a powerful adjunct imaging modality with superior soft tissue contrast resolution and multiplanar

capability. Dynamic contrast-enhanced MRI (DCE-MRI) provides both morphological and functional information, allowing assessment of lesion enhancement patterns, internal architecture, vascularity, and kinetic characteristics. MRI demonstrates the highest sensitivity among all imaging modalities for the detection of breast malignancy, with reported sensitivity ranging from 90% to 99%, especially in cases of dense breasts, multifocal, multicentric, and bilateral disease. However, its specificity remains variable due to overlapping enhancement patterns between benign and malignant lesions. [2-4]

In addition to lesion detection, breast MRI plays a crucial role in preoperative staging, assessment of tumor extent, evaluation of chest wall involvement, detection of residual or recurrent disease, and screening of high-risk populations. MRI is also invaluable in assessing response to neoadjuvant chemotherapy and in distinguishing postoperative scar tissue from recurrent tumor. The standardized interpretation of breast MRI using the Breast Imaging Reporting and Data System (BI-RADS) MRI lexicon has further improved lesion characterization, communication, and management decisions. However, despite these advances, histopathology remains the gold standard for definitive diagnosis of breast lesions. [5-7]

Histopathological examination provides precise tissue diagnosis, grading of tumors, assessment of receptor status, and prognostic markers essential for treatment planning. The combination of clinical findings, imaging, and histopathology—referred to as the triple assessment—achieves near-perfect diagnostic accuracy in the evaluation of breast lumps. Nevertheless, discordance between imaging and histopathology may occur, particularly in lesions with atypical enhancement patterns or borderline pathology, emphasizing the importance of studying the correlation between MRI findings and histopathological outcomes. [8,9]

The study aimed to analyze the MRI findings of breast lumps and correlate them with histopathological and clinical findings to assess its diagnostic efficacy and clinical utility.

MATERIALS AND METHODS

The prospective observational study was conducted in the Department of Surgery at the D. Y. Patil Medical College, Kolhapur, India, over a period of 2 years. 64 patients fulfilling the inclusion criteria were selected for the study. Ethical clearance was obtained from the Institutional Ethics Committee before the commencement of the study.

Inclusion Criteria

Group of females in Reproductive age group with Breast lump, presenting with clinically or radiologically detected breast lumps, who underwent breast MRI

followed by histopathological confirmation (FNAC/core biopsy/excision biopsy), with significant positive family history of breast diseases, willing to participate and provide written informed consent for the study.

Exclusion Criteria

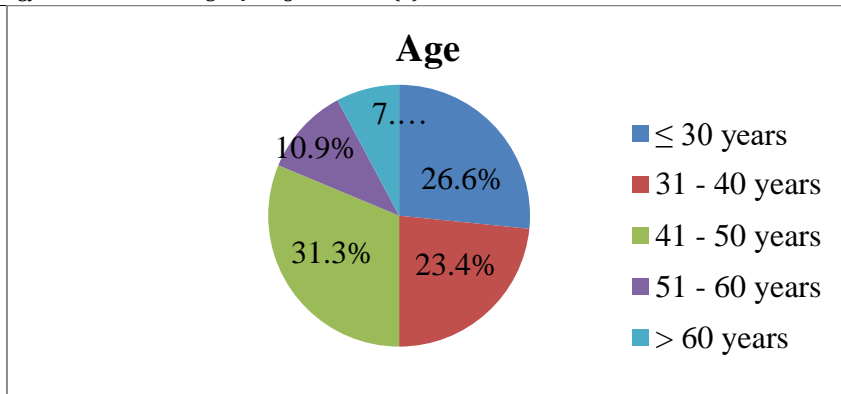
Pregnant female, Lactating mothers, not willing for Biopsy or Surgical excision, other pulmonary or chest wall disease, recurrence of the disease in previously operated patient, Incomplete clinical data, patient not eligible or fit for MRI.

All eligible patients presenting with breast lumps to the Department of Radiology were consecutively enrolled after obtaining written informed consent. The study objectives, MRI procedure, and confidentiality measures were explained to each participant in their native language, and participation was entirely voluntary without affecting ongoing treatment. Detailed demographic and clinical information, including age, menopausal status, presenting symptoms, duration of lump, family history, menstrual and marital history, past drug history, and clinical examination findings, were recorded using a structured pre-tested proforma. Available mammography and ultrasonography findings were documented. All patients underwent breast MRI, and imaging parameters such as lesion size, location, morphology, enhancement characteristics, kinetic curve patterns, and apparent diffusion coefficient (ADC) values were systematically evaluated. Subsequently, patients underwent histopathological confirmation through fine-needle aspiration cytology (FNAC), Trucut biopsy, or excision biopsy, with tissue processing and Hematoxylin and Eosin staining performed according to standard protocols. Based on histopathological findings, lesions were categorized as benign or malignant. The diagnostic performance of MRI was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy using histopathology as the reference standard. All clinical, radiological, and histopathological data, including UHID and final diagnosis, were entered into a master chart for analysis. Statistical analysis was conducted using the SPSS 26.0 version. Association between categorical variables (MRI features vs. histopathology) was assessed using Chi-square test/Fisher's exact test. Level of statistical significance was set at $p < 0.05$.

RESULTS

Table 1: Distribution of subjects according to age

Age	Frequency	Percent
≤ 30 years	17	26.6%
31 - 40 years	15	23.4%
41 - 50 years	20	31.3%
51 - 60 years	7	10.9%
> 60 years	5	7.8%
Total	64	100%
Mean age: 40.6 ± 13.98 years		

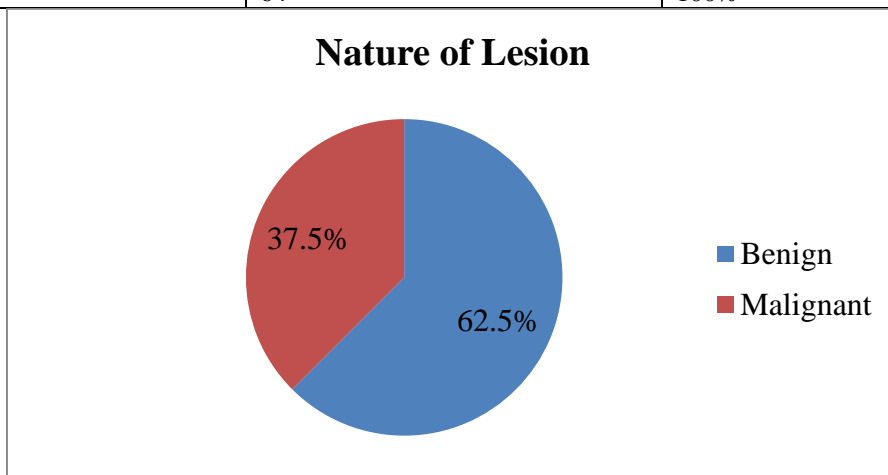


Majority of patients were concentrated in the 41–50 year’s age group (31.3%), followed by the ≤30 year’s group (26.6%) and 31–40 year’s group (23.4%). A smaller proportion of subjects belonged to the 51–60 years (10.9%) and >60 years (7.8%) categories.

The mean age of the study population was 40.6 ± 13.98 years, indicating that most patients were in the middle-aged group, with a relatively wide age distribution as reflected by the standard deviation.

Table 2: Distribution of subjects according to Nature of Lesion

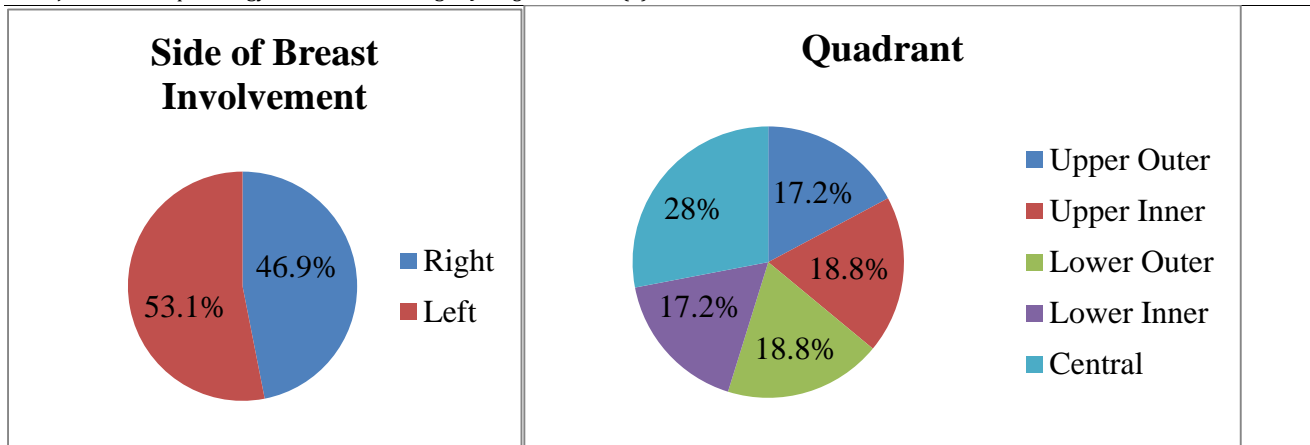
Nature of Lesion	Frequency	Percent
Benign	40	62.5%
Malignant	24	37.5%
Total	64	100%



Majority of breast lesions were benign, accounting for 62.5% (n=40) of cases, while malignant lesions constituted 37.5% (n=24). This distribution indicates that benign breast lumps are more common than malignant ones, which is consistent with the general epidemiological pattern observed in clinical practice. The findings emphasize that although most breast lumps are benign, a significant proportion may be malignant, underscoring the importance of accurate diagnostic evaluation using imaging and histopathology. Early differentiation between benign and malignant lesions is crucial for appropriate management and improving patient outcomes.

Table 3: Anatomical Distribution of Breast Lumps (Combined Side and Quadrant-wise Distribution)

Variable	Category	Frequency (n)	Percentage (%)
Side of Breast Involvement	Right	30	46.9
	Left	34	53.1
Quadrant-wise Distribution	Upper Outer	11	17.2
	Upper Inner	12	18.8
	Lower Outer	12	18.8
	Lower Inner	11	17.2
	Central	18	28.0



In the present study, breast lumps were slightly more common in the left breast (53.1%, n=34) than in the right breast (46.9%, n=30). Regarding anatomical location within the breast, the central quadrant was the most frequently involved site (28.0%, n=18), followed by the upper inner and lower outer quadrants (18.8% each, n=12), while the upper outer and lower inner quadrants each accounted for 17.2% (n=11) of cases. Although a slight predominance of left-sided involvement and central location was observed, breast lumps were distributed across all quadrants and both breasts. These findings emphasize the need for comprehensive clinical and radiological evaluation of the entire breast, including the retroareolar and central regions, to ensure accurate lesion detection and characterization.

Table 4: Distribution of subjects according to Clinical Lump Size

Size (cm)	Frequency	Percent
<2	15	23.4%
2-4	37	57.8%
>4	12	18.8%
Total	64	100%

Mean Clinical Lump Size: 2.9 ± 1.35 cm

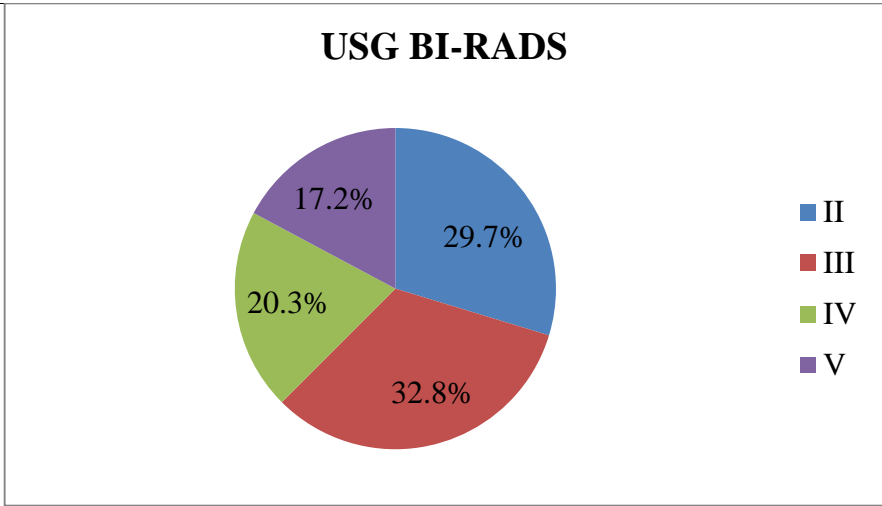
Majority of breast lumps measured 2–4 cm, accounting for 57.8% (n=37) of cases. Smaller lesions measuring <2 cm were observed in 23.4% (n=15) of patients, while larger lumps >4 cm constituted 18.8% (n=12).

The mean clinical lump size was 2.9 ± 1.35 cm, indicating that most patients presented with moderately sized lesions. The relatively wide standard deviation suggests variability in tumor size at presentation.

The findings imply that a significant proportion of patients present at a stage where the lump is already clinically palpable and moderately enlarged. Larger lesions (>4 cm), which are more likely to be associated with malignancy, were less frequent but still notable.

Table 5: Comparison of USG and MRI BI-RADS Categories Among Study Subjects

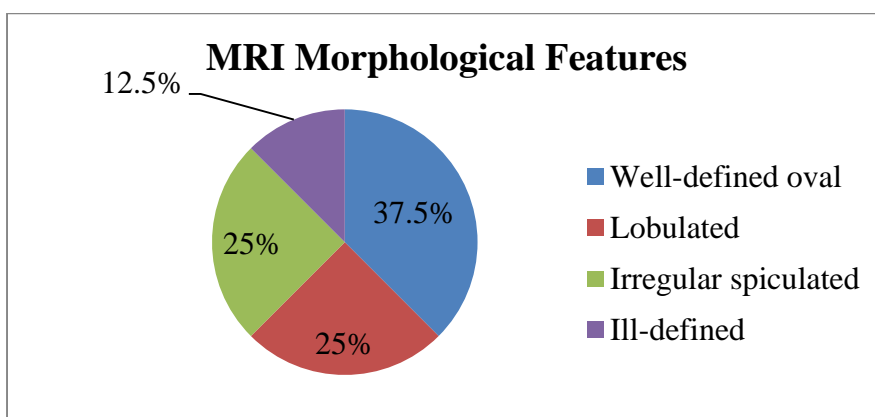
BI-RADS Category	USG n (%)	MRI n (%)
II	19 (29.7%)	20 (31.3%)
III	21 (32.8%)	20 (31.3%)
IV	13 (20.3%)	9 (14.1%)
V	11 (17.2%)	15 (23.4%)
Total	64 (100%)	64 (100%)



The comparison of BI-RADS categories assigned by ultrasonography (USG) and magnetic resonance imaging (MRI) demonstrated that the majority of lesions were classified as BI-RADS II and III by both modalities, indicating a predominance of benign or probably benign lesions in the study population. MRI classified a slightly higher proportion of lesions as BI-RADS II (31.3% vs. 29.7%) and BI-RADS V (23.4% vs. 17.2%) compared to USG, while fewer lesions were categorized as BI-RADS IV (14.1% vs. 20.3%). This shift suggests that MRI provided greater confidence in lesion characterization, enabling more definitive categorization of lesions as either benign or highly suspicious for malignancy. The findings highlight the superior tissue characterization and functional imaging capabilities of MRI, which may improve risk stratification and assist in guiding appropriate biopsy and treatment decisions.

Table 6: MRI Characteristics of Breast Lesions

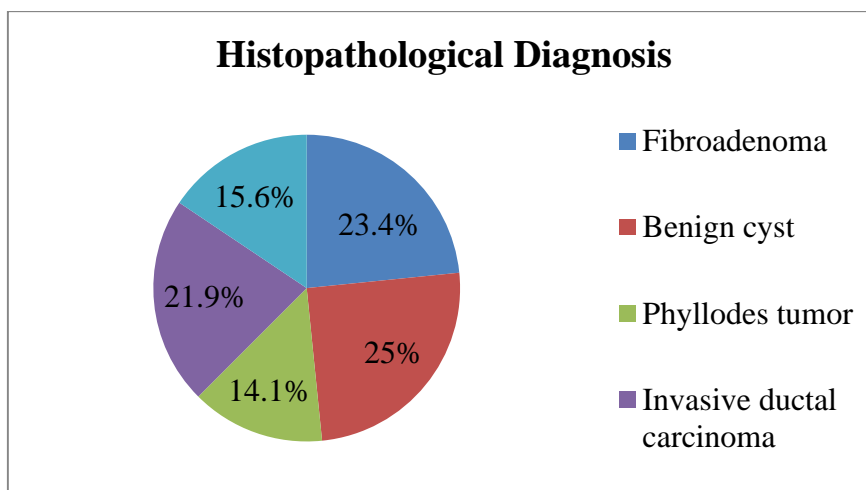
MRI Parameter	Category	Frequency (n)	Percentage (%)
Morphological Features	Well-defined oval	24	37.5
	Lobulated	16	25.0
	Irregular spiculated	16	25.0
	Ill-defined	8	12.5
Enhancement Kinetics Pattern	Persistent	40	62.5
	Washout	24	37.5
Diffusion Restriction (DWI)	Present	24	37.5
	Absent	40	62.5



Among morphological features, well-defined oval lesions were the most common (37.5%, n=24), followed by lobulated and irregular spiculated lesions (25.0% each, n=16), while ill-defined lesions accounted for 12.5% (n=8). Regarding dynamic contrast-enhanced MRI, a persistent enhancement pattern was observed in 62.5% (n=40) of lesions, whereas 37.5% (n=24) exhibited a washout pattern. Diffusion-weighted imaging revealed diffusion restriction in 37.5% (n=24) of cases, while 62.5% (n=40) showed no restriction. Collectively, these findings indicate that well-defined morphology, persistent enhancement, and absence of diffusion restriction were predominantly associated with benign lesions, whereas irregular morphology, washout kinetics, and diffusion restriction were suggestive of malignancy.

Table 7: Distribution of subjects according to Histopathological Diagnosis

Diagnosis	Frequency	Percent
Fibroadenoma	15	23.4%
Benign cyst	16	25.0%
Phyllodes tumor	9	14.1%
Invasive ductal carcinoma	14	21.9%
Invasive lobular carcinoma	10	15.6%
Total	64	100%



In the present study, benign lesions constituted the majority, with benign cysts being the most common diagnosis (25.0%, n=16), followed closely by fibroadenoma (23.4%, n=15) and phyllodes tumor (14.1%, n=9).

Among malignant lesions, invasive ductal carcinoma (IDC) was the most prevalent (21.9%, n=14), followed by invasive lobular carcinoma (ILC) (15.6%, n=10).

Overall, benign lesions accounted for a larger proportion of cases, reflecting the common clinical observation that most breast lumps are non-malignant. However, the presence of a substantial number of malignant cases, particularly IDC, highlights the clinical importance of early and accurate diagnosis.

Table 8: Distribution of subjects according to Malignant Cases

Diagnosis	Frequency/Mean	Percent/SD
TNM Staging of Malignant Cases		
Stage I	9	37.5%
Stage II	8	33.3%
Stage III	7	29.2%
Tumor Grade Distribution		
Grade I	6	25.0%
Grade II	11	45.8%
Grade III	7	29.2%
Lymphovascular Invasion (LVI)		
Present	13	54.2%

Absent	11	45.8%
Total	24	100%
Hormone Receptor Status		
ER Positive	7	29.2%
PR Positive	12	50%
HER2 Positive	12	50%
Ki67(%)	36.5	16.38

Among the 24 malignant cases, the majority were diagnosed at an early to intermediate stage, with Stage I accounting for 37.5% (n=9), followed by Stage II (33.3%, n=8) and Stage III (29.2%, n=7). This indicates that a considerable proportion of malignancies were detected at a potentially treatable stage, although a notable percentage still presented with advanced disease.

With respect to tumor differentiation, Grade II tumors were the most common (45.8%, n=11), followed by Grade III (29.2%, n=7) and Grade I (25.0%, n=6). This suggests that the majority of tumors were moderately differentiated, reflecting an intermediate biological behavior.

Lymphovascular invasion (LVI) was present in 54.2% (n=13) of cases, indicating a significant proportion of tumors with aggressive characteristics and higher metastatic potential.

Regarding hormone receptor status, PR positivity (50%) and HER2 positivity (50%) were observed in half of the cases, while ER positivity was noted in 29.2% (n=7).

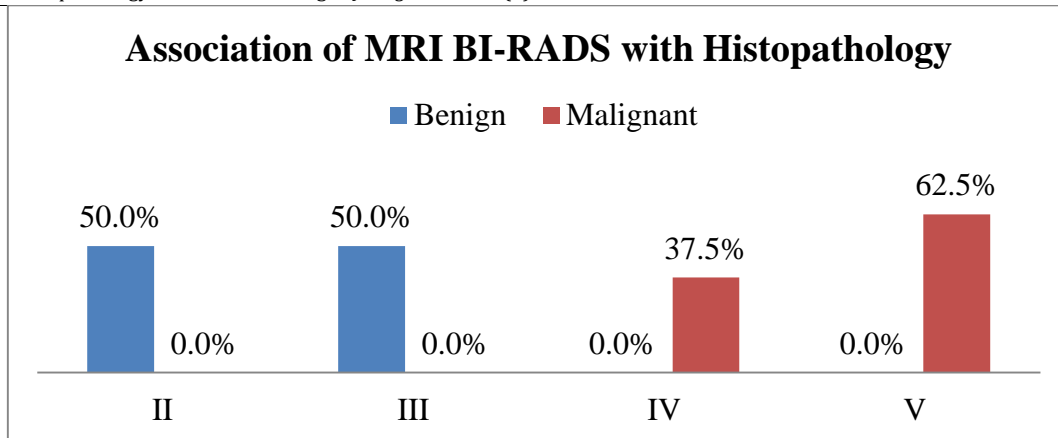
This distribution reflects a mixed molecular profile, with a subset of patients potentially benefiting from hormonal and targeted therapies.

The mean Ki-67 index was $36.5 \pm 16.38\%$, indicating a relatively high proliferative activity among malignant tumors, which is often associated with more aggressive tumor behavior and poorer prognosis.

Overall, these findings highlight that malignant breast lesions in this study demonstrate moderate to high-grade pathology, significant lymphovascular invasion, and variable receptor expression, emphasizing the importance of comprehensive histopathological and molecular evaluation for guiding treatment and prognostication.

Table 9: Association of MRI Findings with Histopathological Diagnosis

MRI Parameter	Category	Benign n (%)	Malignant n (%)	χ^2 Value	p-value
MRI BI-RADS	II	20 (50.0)	0 (0.0)	64.000	<0.001
	III	20 (50.0)	0 (0.0)		
	IV	0 (0.0)	9 (37.5)		
	V	0 (0.0)	15 (62.5)		
Diffusion Restriction (DWI)	Present	0 (0.0)	24 (100.0)	64.000	<0.001
	Absent	40 (100.0)	0 (0.0)		
Enhancement Kinetics Pattern	Washout	0 (0.0)	24 (100.0)	64.000	<0.001
	Persistent	40 (100.0)	0 (0.0)		
MRI Morphology*	Benign morphology†	40 (100.0)	0 (0.0)	64.000	<0.001
	Malignant morphology‡	0 (0.0)	24 (100.0)		
Total		40 (100.0)	24 (100.0)		



Morphological classification grouped according to histopathological correlation. Benign morphology: fibroadenoma, benign cyst, and phyllodes tumor patterns.

Malignant morphology: invasive ductal carcinoma and invasive lobular carcinoma patterns.

A highly significant association was observed between MRI findings and histopathological diagnosis. All lesions categorized as MRI BI-RADS II and III were benign, whereas all BI-RADS IV and V lesions were malignant ($\chi^2 = 64.000$, $p < 0.001$). Similarly, diffusion restriction on DWI was present in all malignant lesions and absent in all benign lesions, demonstrating a perfect correlation with histopathology ($\chi^2 = 64.000$, $p < 0.001$). Enhancement kinetics also showed a strong association, with all malignant lesions exhibiting a washout pattern and all benign lesions demonstrating persistent enhancement ($\chi^2 = 64.000$, $p < 0.001$). Furthermore, MRI morphology accurately differentiated benign from malignant lesions, with benign morphological patterns corresponding exclusively to benign histopathology and malignant morphological patterns corresponding exclusively to malignant histopathology ($\chi^2 = 64.000$, $p < 0.001$). These findings indicate that MRI BI-RADS assessment, diffusion-weighted imaging, enhancement kinetics, and morphological evaluation are highly reliable parameters for distinguishing benign from malignant breast lesions and correlate strongly with histopathological outcomes.

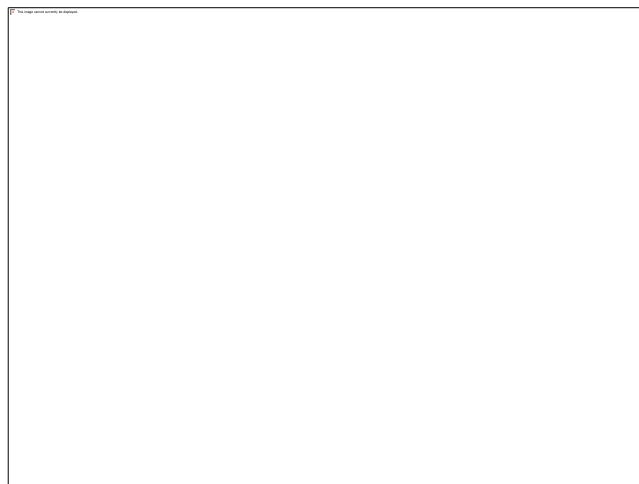


Figure 1: Representative histologic sections from the fibroadenomas

(A) Biphasic growth proliferation composed of benign breast ducts and stroma (HEx40).

(B) Higher magnification view showing the benign ducts with 2 layers: inner luminal epithelium and outer layer of myoepithelial cells with clear cytoplasm (HEx200).

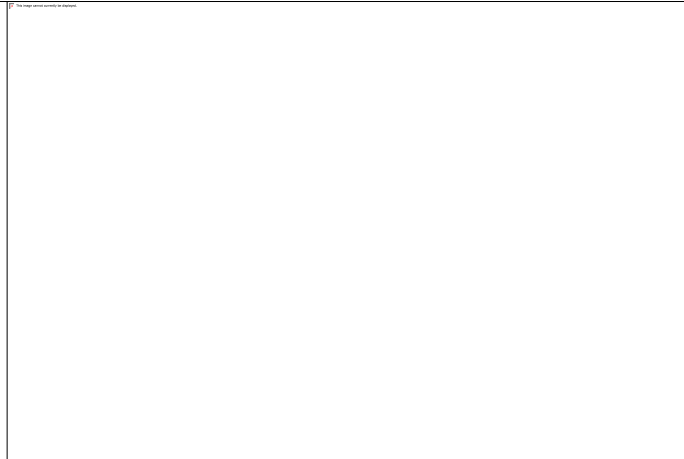


Figure 2: Micrograph of a phyllodes tumor (right of image) with the characteristic long clefts and myxoid cellular stroma. Normal breast and fibrocystic change are also seen (left of image). H&E stain.



Figure 3: Comparison of a benign and malignant breast tumour on DWI with ADC mapping at 7 T. (a) On DCE-MRI, the benign lesion, which is a fibroadenoma, is oval, circumscribed, and shows non-enhancing septa. (b) On the high b-value (b-850) images the lesion is hyperintense due to T2-shinethrough, but on the ADC map (c) there is no restricted diffusivity with ADC values of $2.226 \times 10^{-3} \text{mm}^2/\text{s}$. (d) On DCE-MRI, the malignant lesion (invasive ductal carcinoma grade 3) is irregular shaped and marginated and shows heterogeneous enhancement. (e) On the high b-value (b-850) images, the lesion is hyperintense, and (f) on the ADC map, there is restricted diffusivity (i.e., hyperintense) with ADC values of $0.728 \times 10^{-3} \text{mm}^2/\text{s}$

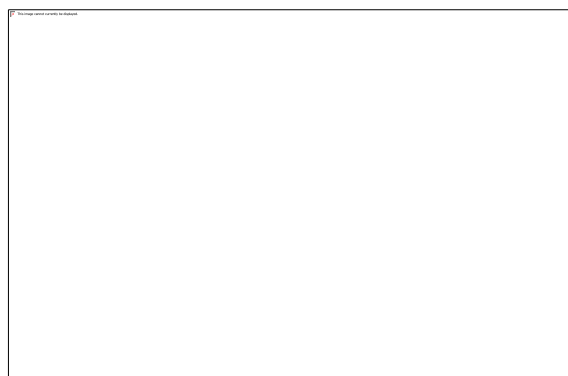


Figure 4: Breast imaging in women with hereditary lobular breast cancer.

A mammogram demonstrated subtle asymmetry in the left breast on both mediolateral (a) and craniocaudal (b) views. Follow-up imaging with breast MRI axial MIP (maximum intensity projection) (c) showed an approximate 7-cm region of non-mass enhancement (red circle) and a prominent left axillary node with rounded morphology, which was also seen on the original mammogram (red arrow). Final pathology demonstrated a 7-cm mixed ductal/lobular carcinoma in both the left upper outer quadrant and the left lower outer quadrant. In contrast, a 45-year-old woman with known germline CDH1 P/LP variant received a recommended screening breast MRI (d), which demonstrated multiple small enhancing masses in the left breast, seen on an axial MIP image (red circle). Follow-up ultrasound and biopsy with clip placement confirmed two sites of malignancy in the left breast. Post-biopsy mammogram assessing clip placement sites demonstrated dense breast tissue without an obvious mass at biopsy sites on either the mediolateral (e) or craniocaudal (f) views. The final pathology for this individual demonstrated a 1.1-cm invasive lobular carcinoma. To showcase MRI detection of uncommon features, (g) depicts a 66-year-old female with known germline CDH1 P/LP variant originally diagnosed with a 6-cm

invasive lobular breast carcinoma at age 65 who was treated with bilateral mastectomy and systemic chemotherapy but developed skin changes the following year; follow-up breast MRI demonstrated several prominent intramammary and axillary lymph nodes (red circle, sagittal view) with subdermal enhancing abnormalities and skin thickening signaling recurrence of disease (red arrows). Last, techniques such as STIR may further assist in the detection of tumors on breast MRI, as seen in Figures h, i: in this case, a 52-year-old female with a known germline CDH1 variant demonstrated an ill-defined large infiltrating tumor in the right breast on post-contrast axial MRI (h), correlating with parenchymal edema on corresponding STIR sequence (i).

DISCUSSION

The present study was undertaken to evaluate the role of magnetic resonance imaging (MRI) in the characterization of breast lumps and its correlation with clinical findings and histopathology, which remains the gold standard.

The study evaluated the role of magnetic resonance imaging (MRI) in the characterization of breast lumps and its correlation with histopathological findings. The majority of patients belonged to the 41–50 years age group (31.3%), with a mean age of 40.6 ± 13.98 years, indicating that breast lumps are predominantly encountered in middle-aged women. Similar observations were reported by Datta et al. [10] and Mohan et al. [11], who documented a peak incidence of breast lesions in the fourth and fifth decades of life. The substantial representation of younger women in the present study may be attributable to the higher prevalence of benign lesions such as fibroadenoma in this age group.

Benign lesions constituted 62.5% of cases, while malignant lesions accounted for 37.5%. This predominance of benign pathology is consistent with findings reported by Sharma et al. [12] and Chavan et al. [13], who observed that most breast lumps are non-malignant. However, the relatively higher proportion of malignant lesions in the present study may reflect the tertiary care setting, where clinically suspicious cases are more frequently referred, as also noted by Datta et al. [10]

Regarding anatomical distribution, breast lumps were slightly more common in the left breast (53.1%) than in the right breast (46.9%). The central quadrant was the most frequently involved location (28%), followed by a relatively uniform distribution across the remaining quadrants. Although most studies report a predominance of lesions in the upper outer quadrant due to the greater volume of glandular tissue, Datta et al. [10] emphasized that lesions may occur throughout the breast and require comprehensive evaluation.

The majority of lesions measured 2–4 cm (57.8%), with a mean clinical size of 2.9 ± 1.35 cm. These findings indicate that most lesions were clinically palpable at presentation. Comparable observations were reported by Ramani et al. [14], who found that most breast lesions evaluated by MRI were clinically detectable masses. The ability of MRI to accurately delineate lesion extent is

particularly important in lesions of this size range and in patients with dense breast tissue.

Comparison of BI-RADS categorization between ultrasonography and MRI demonstrated that both modalities classified the majority of lesions as BI-RADS II or III. However, MRI assigned a higher proportion of lesions to BI-RADS V and fewer lesions to BI-RADS IV, suggesting greater confidence in lesion characterization. These findings support the superior soft-tissue contrast and functional imaging capabilities of MRI. Similar results have been reported by Bluemke et al. [3], who demonstrated the high sensitivity of MRI in detecting breast malignancy, and Mohan et al. [11], who reported strong correlation between MRI BI-RADS classification and histopathological diagnosis.

Assessment of MRI characteristics revealed that well-defined oval lesions were the most common morphological pattern (37.5%), followed by lobulated lesions (25.0%). Functional MRI evaluation showed persistent enhancement in 62.5% of cases and diffusion restriction in 37.5%. These findings indicate that benign lesions were generally characterized by smooth margins, persistent enhancement, and absence of diffusion restriction, whereas malignant lesions demonstrated irregular morphology, washout kinetics, and restricted diffusion. Fischer et al. [7] reported that MRI morphology accurately reflects tumor characteristics and extent, while Lehman et al. [15] demonstrated excellent imaging–pathological concordance in breast MRI evaluation.

Histopathological examination revealed that benign cysts (25.0%) and fibroadenomas (23.4%) were the most common benign lesions, whereas invasive ductal carcinoma (21.9%) was the predominant malignant subtype. Similar distributions have been reported by Mohan et al. [11] where fibroadenoma represented the most frequent benign lesion and invasive ductal carcinoma was the most common malignancy. These findings reflect the established epidemiological spectrum of breast disease.

Among malignant lesions, Stage I disease constituted 37.5% of cases, followed by Stage II (33.3%) and Stage III (29.2%). Grade II tumors were most common (45.8%), and lymphovascular invasion was present in 54.2% of cases. Hormone receptor analysis demonstrated ER positivity in 29.2%, PR positivity in 50%, and HER2 positivity in 50% of tumors. The mean Ki-67 index was $36.5 \pm 16.38\%$, indicating relatively high proliferative

activity. Similar findings have been reported by Datta et al. [10], Mohan et al. [11], and Yadav et al. [16], who observed a predominance of moderately differentiated tumors and emphasized the association between MRI features and tumor aggressiveness.

A major finding of the present study was the highly significant association between MRI findings and histopathological diagnosis ($p < 0.001$). All lesions categorized as MRI BI-RADS II and III were benign, whereas all BI-RADS IV and V lesions were malignant. Similarly, diffusion restriction and washout enhancement kinetics were observed exclusively in malignant lesions, while persistent enhancement and absence of diffusion restriction were confined to benign lesions. MRI morphological features also demonstrated excellent agreement with histopathological diagnosis. These observations are supported by Bluemke et al. [3], Partridge et al. [17], who reported strong correlations between MRI morphology, enhancement kinetics, diffusion characteristics, and pathological outcomes.

Overall, the findings of the present study demonstrate that MRI provides comprehensive structural and functional assessment of breast lesions, enabling accurate differentiation between benign and malignant pathology. The excellent concordance observed between MRI findings and histopathology highlights the value of MRI as an important adjunct to conventional imaging and histopathological evaluation, particularly in indeterminate lesions, preoperative assessment, and treatment planning.

A major strength of the present study is the comprehensive evaluation of breast lesions using multiparametric MRI, including BI-RADS classification, morphological assessment, enhancement kinetics, and diffusion-weighted imaging, with all findings correlated against histopathology as the gold standard. The study demonstrated highly significant associations between MRI parameters and histopathological diagnosis, highlighting the excellent diagnostic accuracy of MRI in differentiating benign and malignant lesions. Additionally, the assessment of tumor stage, grade, receptor status, lymphovascular invasion, and Ki-67 index provided valuable insights into tumor biology and prognostic characteristics. However, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings due to referral bias and a relatively higher proportion of suspicious or advanced cases. Furthermore, MRI interpretation may be operator-dependent, and the study did not evaluate interobserver variability or the cost-effectiveness of MRI in routine clinical practice.

CONCLUSION

The present study demonstrates that magnetic resonance imaging (MRI) is a highly effective and reliable modality in the evaluation of breast lumps, serving as a valuable adjunct to clinical examination and histopathology. MRI

showed excellent diagnostic accuracy and strong concordance with histopathological findings, with highly significant associations ($p < 0.001$) observed for BI-RADS classification, morphological features, enhancement kinetics, and diffusion-weighted imaging (DWI). MRI BI-RADS categories accurately predicted lesion nature, while diffusion restriction and washout enhancement patterns were strongly associated with malignancy, and persistent enhancement patterns were indicative of benign lesions.

Histopathological evaluation confirmed that benign lesions predominated, with fibroadenoma and cysts being the most common, whereas invasive ductal carcinoma was the most frequent malignant lesion. Among malignant cases, moderate to high tumor grades, lymphovascular invasion, and elevated Ki-67 index indicated biologically aggressive disease. MRI also proved valuable in assessing tumor characteristics, staging, lesion extent, and treatment planning. Overall, the study concludes that MRI is a highly sensitive and specific imaging modality that significantly enhances the evaluation of breast lumps, improves diagnostic accuracy, and plays a critical role in guiding biopsy, staging, and therapeutic decisions. While histopathology remains the gold standard, MRI serves as an indispensable non-invasive tool in modern breast imaging.

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