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Relation between morphological features of initial breast MRI and breast cancer molecular subtypes

Safaa Mohammed Temerik[1]* , Saeda Mohamed Abd Elwahab[2], Mohammed Mostafa Wahman[1], Mohammed Youssef Ahmed[3] and Mostafa Elsayed Abd Elwanis[4]

Abstract

Background Because different gene receptors might cause each case of breast cancer, the disease is classified as a heterogeneous form because it can be subdivided into molecular subtypes. These molecular subtypes are different in disease manifestation, therapeutic response, and prognosis. Magnetic resonance imaging (MRI) has many applications in breast cancer's initial diagnosis and assessment of treatment response. The purpose of this research was to determine whether or not there is a correlation between specific morphological aspects of breast MRI in breast cancer and specific breast cancer subtypes and their impact on treatment decisions.

Results There was an insignificant difference between different mass shapes and different molecular subtypes ($P > 0.05$). One hundred percent of triple-negative breast cancers (TNBC) were rounded. Molecular subtypes and the spiculated mass border diverged significantly statistically ($P = 0.023$). The percentage of the hormonal receptor (HR)-positive breast cancers with a spiculated border (80%) was greater than TNBC (0%) and distinctively different ($P = 0.044$). Surgical alternatives were observed to correlate significantly with the MRI mass border type ($P = 0.030$). There was an insignificant difference between molecular subtypes and tumor size ($P = 0.602$), lymph nodes ($P = 0.283$), multicentricity ($P = 0.386$), and curve type ($P = 0.107$).

Conclusions MRI breast imaging has an important role in diagnostic and prognostic settings. The morphological results of MRI can be a helpful tool in distinguishing between the various subtypes of breast cancer. There was a statistically significant difference between different molecular subtypes and the spiculated mass border ($P = 0.023$). There was a statistically significant difference between the type of breast cancer surgery and the mass border ($P = 0.030$).

Keywords Magnetic resonance imaging, Breast cancer, Molecular subtypes, Morphological features

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Background

Breast cancer, often known as BC, is regarded as one of the most significant health issues in Egypt as well as the rest of the globe. It is the most frequent cancer in Egyptian women, accounting for 33 percent of all malignancies, and it is the second most common cause of cancer-related fatalities [1, 2].

On the basis of the expression of the estrogen receptor (ER), the progesterone receptor (PR), and the human epidermal growth factor receptor-2 (HER2), breast cancer molecular subtypes are classified as either luminal

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A, luminal B, HER2, or TNBC. Different illness manifestations, responses to treatment, and rates of patient survival are associated with each of these subtypes [3]. Patients with the luminal A subtype have the best prognosis, followed by patients with the luminal B subtype, who have a prognosis that falls somewhere in the middle, and finally the TN subtype, which is associated with a poor prognosis. There is a correlation between HER2-enriched subtypes and responsiveness to targeted therapy [4]. As a result, breast cancer is recognized as a distinct disease, and the practice of customized treatment is becoming increasingly common [5].

Differences in response to treatment and prognosis can occur between patients with breast cancer, as evidenced by the observed heterogeneity across patients and within individual tumors [6].

For the treatment of breast cancer, radiological diagnostic technologies that may anticipate how tumors will behave are becoming an increasingly important component [7]. Because it is possible to obtain high-resolution images based on morphological and functional characteristics using modern MRI technology, MRI is regarded as a potent instrument for the diagnosis of breast cancer. This is due to the fact that MRI may be used to do an assessment of the entire breast [6, 8].

In addition, MRI is a useful method for detecting breast cancer at an early stage, as other modalities like mammography and ultrasonography have low specificity and sensitivity. Early diagnosis of breast cancer becomes an effective key to successful treatment [9].

In addition to mammography and ultrasonography, the use of various MRI techniques has emerged as an essential adjunctive method [10]. Dynamic contrast enhancement (DCE) images, diffusion-weighted imaging (DWI), and other MRI sequences make up multi-parametric MRI, an indispensable imaging modality [11].

Studies on MRI's efficacy in diagnosing breast cancer have revealed a sensitivity of about 100%, although specificity varies depending on whether the morphological aspects or the enhancement pattern are being evaluated [12].

Breast MRI can be used for a wide variety of diagnostic and therapeutic purposes, including the detection of occult primary tumors and lymph nodes, the examination of nipple lesions and suspicious discharge, and the assessment of response to neoadjuvant therapy [13].

Lesions are categorized by the BI-RADS lexicon as foci, masses, and non-mass enhancement. The form, borders, and pattern of internal augmentation of masses allow for additional differentiation. Both the early and late stages of improvement are outlined so that a more accurate diagnosis may be made [14].

Unifocal breast cancer is defined as having only one separate lesion. Multicentric breast cancer is where two or more tumors are present in more than one quadrant of the same breast, or those separated by > 4–5 cm from each other. Multifocal breast cancer is defined as two or more tumors found in the same quadrant of the breast [15].

In order to better define prognosis and individualized treatment strategies for breast cancer patients, researchers have investigated the association between morphological and kinetic MRI findings and breast cancer subtypes [16, 17].

The purpose of this study was to establish whether or not the findings of MRIs can accurately predict the molecular subtypes of breast cancer. Specifically, we wanted to evaluate the link between certain morphological aspects of breast MRI in breast cancer and breast cancer subtypes and their impact on treatment decisions.

Methods

Our study was cross-sectional and observational with a single group at the Clinical Oncology, Radiodiagnosis, and General Surgery departments. Thirty women who had just received a true-cut biopsy diagnosis of invasive breast cancer were enrolled in the trial; their ages ranged from twenty-two to sixty-five years; and their stages ranged from I to III. Serum creatinine was tested and should be $< / = 1.3$ and GFR > 40. The study was from February 2021 to February 2023. An initial MRI breast examination was obtained for initial staging before any active treatment to assess the impact of MRI on treatment decisions. Patients whose ages are less than 18 years, pregnant, not pathologically proven breast cancer, patients contraindicated to gadolinium chelate contrast agents, metal items in patients, pacemakers, or Claustrophobia were excluded from our study.

MRI protocol

All of the breast MRI examinations were carried out using a high-field system that contained a 1.5-T magnetic resonance imaging system (Achieva; Philips Medical Systems, Best, The Netherlands) and a dedicated four-channel breast array coil. Each patient was positioned in a prone position. The pulse sequence parameters were as follows:

1. T1-weighted gradient-echo MRI(5.5/2.7; flip angle 100; field of view, 360 mm; matrix, 480 * 480; section thickness, 2 mm; section gap, 1 mm).
2. T2-weighted imaging (4684/130; echo train length, 15; field of view, 360 mm; matrix, 480 * 480; slice thickness, 2 mm; section gap, 0 mm).

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3. DCE axial T1-weighted imaging with fat suppression after an intravenous bolus injection of 0.1 mmol/kg gadolinium.

Sixteen years experienced radiologist interpreted MRI images.

Pathological molecular subtypes assessment

Molecular subtypes were determined depending on immunohistochemistry (IHC) for ER, PR, HER2 expression, and the Ki-67 index. Initial true-cut biopsy specimen sections were immunostained using a Ventana BenchMark GX autostainer. The Ventana UltraView DAB detection system was used. ER, PR, and HER2 were performed using the methodology outlined in the latest ASCO/CAP testing guidelines [18, 19].

If the HER2 IHC was 3+, it was termed positive. If IHC was 2+, the test was reflexed by fluorescence in situ hybridization. Cancers with 1%–100% of cells positive for ER and PR expression are considered HR (hormonal receptor) positive.

- Luminal A subtype: ER- and/or PR-positive, HER2-negative, and Ki-67 < 20%.
- Luminal B subtype: either ER- and/or PR-positive, HER2-negative, and Ki-67 ≥ 20%) or ER- and/or PR-positive and HER2-positive.
- HER2-enriched type (HER2): ER- and PR-negative and HER2-positive.
- Triple-negative type (TN): ER, PR, and HER2-negative [20].

Data collection

Medical records of patients were revised for history, physical examination, and initial breast sonomammography. Histopathology reports of the initial biopsy of the mass included pathological type, tumor grade, Ki-67%, and hormonal receptor status (ER, PR, Her 2 neu).

Ethical considerations

1. Approving study: After receiving approval from the Committee of Clinical Oncology department, the study was also given permission to proceed by the ethics committee. The ethical approval code is MED-ONM027-1–21-2–138.
2. Patient Consent: The purpose of the work, as well as its specifics, was explained to all of the participants in the current investigation, and each subject gave their informed consent to take part in the research in written form and for publication.

Data management and statistical analysis

The IBM Social Science Package (IBM SPSS) version 26 was used to collect, code, and modify the acquired data before entering it into the program. For the categorical variables, the data were given as numbers and percentages, and for the numerical variables, they were presented as means, standard deviations, and ranges according to the parametric distribution.

Results

Eleven (36.7%) patients had a unicentric tumor, while nineteen (63.3%) patients had a multicentric tumor. In terms of tumor size, two (6.7%) patients were T1, sixteen (53.3%) patients were T2, four (13.3%) patients were T3, and eight (26.7%) patients were T4. Twenty-five (83.3%) patients had positive lymph nodes. Regarding the lesion site, twenty (66.7%) patients had an upper quadrant lesion, fourteen (46.7%) patients had a lower quadrant lesion, and twelve (40%) patients had a central lesion. Four (13.3%) patients had a contralateral breast lesion. Five (16.7%) patients had a benign lesion. Regarding the mass shape, 15 (50%) patients had a rounded mass, 12 (40%) patients had an irregular mass, and only two (6.7%) patients had an oval one (Fig. 1). Nineteen (63.3%) patients had a spiculated mass border, eight (26.7%) patients had an irregular border, two (6.7%) patients had an angulated border, and only one (3.3%) patient had a well-defined border (Fig. 2). Twenty (66.7%) patients had a type 2 curve, nine (30%) patients had a type 3 curve, and only one (3.3%) patient had a type 1 curve (Table 1).

Molecular subtypes

Twenty (66.7%) patients were ER (estrogen receptor) positive; eighteen (60%) patients were PR (progesterone receptor) positive; twelve (40%) patients were HER2 (human epidermal growth factor receptor-2) positive; and only three (10%) patients were TNBC. For the tumor subtypes of 30 breast cancers, 15 (50%) were luminal A, 7 (23.3%) were luminal B, 5 (16.7%) were HR-HER2+, and 3 (10%) were TNBC (Table 2).

There was an insignificant difference between different mass shapes and different molecular subtypes (P > 0.05); 100% of TNBC were rounded (Fig. 3), 46.7% of HR-positive tumors were irregular, 40% were rounded, and only 6.7% were oval. Forty-one and seven-tenths percent of HER-2-positive tumors were both rounded and irregular, while 6.7% were oval (Fig. 4). There was a difference that could be considered statistically significant between the various molecular subtypes and the hypothesized mass boundary ($P = 0.023$). Post hoc testing using Bonferroni correction was done to determine the nature of the difference between those subtypes. This analysis revealed
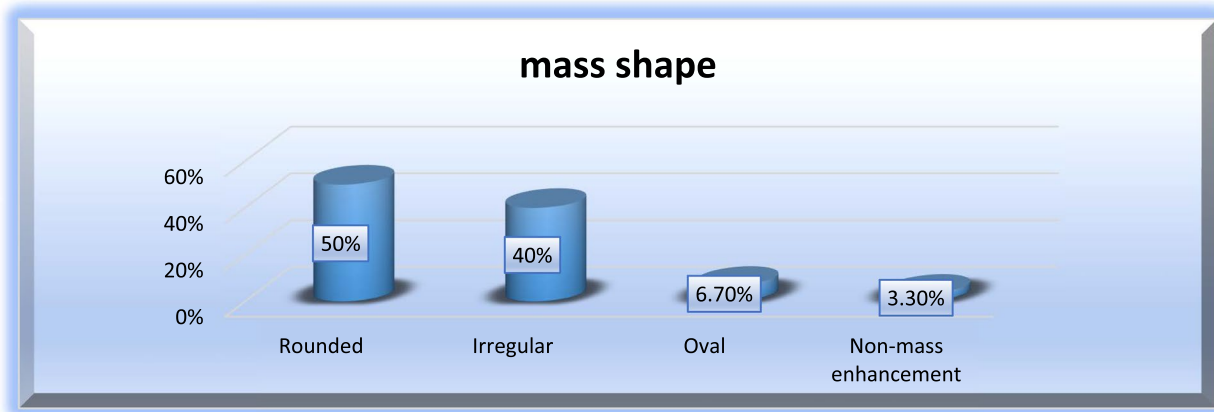
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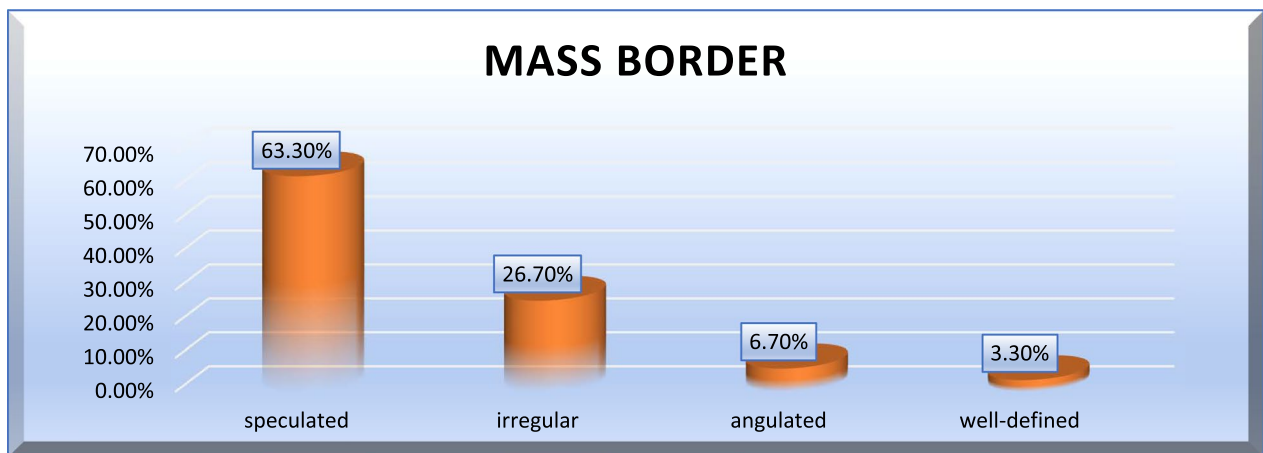
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Fig. 1 Mass shapes in MRI

Fig. 2 Mass borders in MRI

that the percentage of HR-positive breast cancers with a spiculated border (80%) was greater than TNBC (0%); however, there is a major distinction ($P=0.044$) (Figs. 5, 6). There was an insignificant difference between molecular subtypes and tumor size ($P=0.602$), lymph nodes ($P=0.283$) (Fig. 7), multicentricity ($P=0.386$) (Figs. 8, 9), and curve type ($P=0.107$) (Table 3).

Regarding surgical treatment, twenty-one (72.4%) patients had MRM (modified radical mastectomy), and eight (27.6%) patients had BCS (breast conservative surgery). When comparing BCS with MRM, the mass border differed in a statistically significant way ($P=0.030$): 3 patients (16.7%) of those with a speculated mass border were exposed to BCS, compared to 83.3% with MRM; 2 (25%) patients of those with an irregular mass border were exposed to BCS, compared to 75% with MRM; all patients with an angulated mass border had BCS, compared to nobody with MRM; and all patients

with a well-defined mass border had BCS, compared to nobody with MRM. There was an insignificant difference between BCS and MRM regarding mass shape ($P=0.575$) and multicentricity ($P=0.408$) (Table 4).

Discussion

Breast cancer heterogenicity is related to the presence of a wide variety of molecular subtypes. Each molecular subtype has different phenotyping, risk factors, presentation, prognosis, therapeutic responses, and patient outcomes[10].

The aim of our study was the assessment of the morphological criteria of breast cancer lesions and their relation to molecular subtypes as a promising addition in the era of personalized medicine. Morphological features of breast lesions in breast MRI in our study included shape, border, multicentricity, tumor size, and lymph node status.

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Table 1 Patients' MRI criteria

Parameters	Number	Percent
Multicentricity		
Unicentric	11	36.7
Multicentric	19	63.3
Tumor size (MRI)[1]		
T1	2	6.7
T2	16	53.3
T3	4	13.3
T4	8	26.7
Lymph nodes (MRI)		
Positive	25	83.3
Negative	5	16.7
Lesion site		
Upper quadrant	20	66.7
Lower quadrant	14	46.7
Central	12	40
Contralateral breast lesion (MRI)4	4	13.3
Benign lesions in MRI5	5	16.7
Mass shape		
Round	15	50
Oval	2	6.7
Irregular	12	40
Non-mass enhancement	1	3.3
Mass margin		
Speculated	19	63.3
Irregular	8	26.7
Angulated	2	6.7
Well-defined	1	3.3
Curve types		
Type 1	1	3.3
Type 2	20	66.7
Type 3	9	30

[1] T1: tumor ≤ 20 mm in greatest dimension, T2 tumor > 20 mm but ≤ 50 mm in greatest dimension; T3 tumor > 50 mm in greatest dimension; T4 any size tumor that has direct extension to the chest wall and/or to the skin (ulceration or macroscopic nodules); penetration of the dermis alone is not sufficient to qualify as T4 [21]

Table 2 Molecular subtypes among patients (N = 30)

Molecular subtype	Number	Percent
ER status		
ER Positive	20	66.7
ER-negative	10	33.3
PR status		
PR positive	18	60
PR negative	12	40
HER2 status		
HER2 positive	12	40
HER2 negative	18	60
Triple-negative		
Yes	3	10
No	27	90
(HR-positive, HER2-negative)	15	50
(HR-positive, HER2 positive)	5	16.7
HER2-enriched	12	40
Ki-67 index status		
< 20	18	60
≥ 20	12	40

ER estrogen receptor, *PR* progesterone receptor, *HER2* human epidermal growth factor receptor-2

According to the BI-RADS lexicon, there are four possible categories for shape: round, oval, lobulated, and irregular. The outline of lobulated masses has an undulating quality. Irregular masses have an uneven shape that cannot be described as round, oval, or lobulated, and so the term "irregular" is applied to them [22].

In our study, 15 (50%) patients had a rounded mass, 12 (40%) patients had an irregular mass, and only two (6.7%) patients had an oval one. There was an insignificant difference between different mass shapes and different molecular subtypes (P > 0.05). One hundred percent of TN breast cancers were rounded. Forty-six and seven-tenths percent of HR (hormonal receptor) positive breast cancers were irregular, while 40% were rounded, and only 6.7% were oval. TN breast cancer is mostly presented and masked with benign morphological criteria, indicating a poor prognosis. These benign criteria may be explained by the rapid growth of the tumor, leading to central necrosis. Mohammed et al. [23] reported that TN tumors displayed a non-irregular shape more often than other tumors, such as a round, oval, or lobulated shape, with the round shape being the most common. However, the majority of lumen A and lumen B tumors are believed to be irregularly shaped. HER2-positive tumors typically take the shape of spherical lumps. The study of Du et al. [24] demonstrated significant differences in mass shape (P = 0.001) for molecular subtypes.

Regarding the margin of breast lesions in breast MRI scans, they can be described as smooth, uneven, or spiculated depending on their appearance. Spiculated margins are a common hallmark of malignant cancers of the breast [25]. Throughout this investigation, nineteen (63.3%) patients had a speculated mass margin, eight (26.7%) patients had an irregular margin, two (6.7%) patients had an angulated margin, and only one (3.3%) patient had a well-defined margin. Variations in molecular types and the predicted mass margin were statistically distinct (P = 0.023). We found that HR-positive breast cancers with a speculated border (80%) were greater than TNBC (0%), with a significant
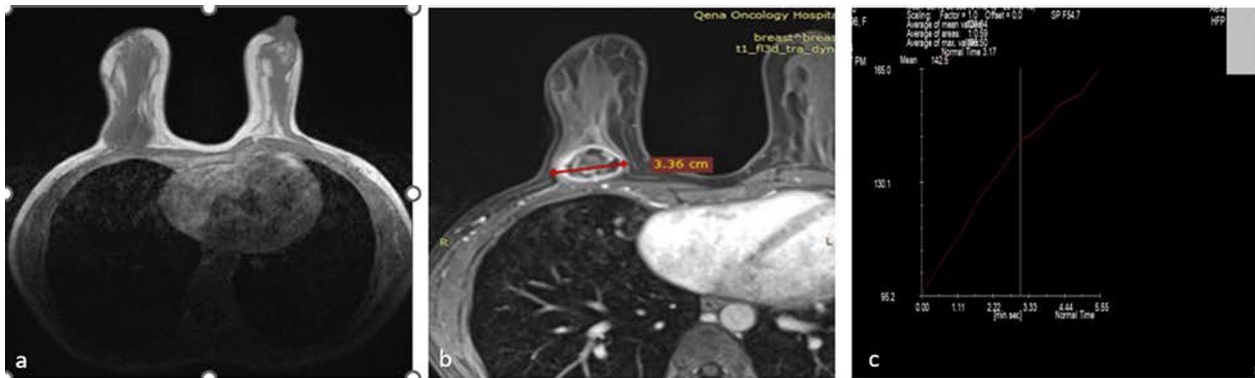
Fig. 3 A 26-year-old female patient, presented clinically with right breast cancer. Initial MRI revealed: a unifocal mass in the lower outer quadrant of the right breast, round to oval shape, well-defined border, and infiltrating chest wall. Pathological analysis revealed: infiltrating duct carcinoma (IDC), grade (G) 2, TN subtype. **a** T1WI, **b** contrast-enhanced T1WI, **c** type I curve
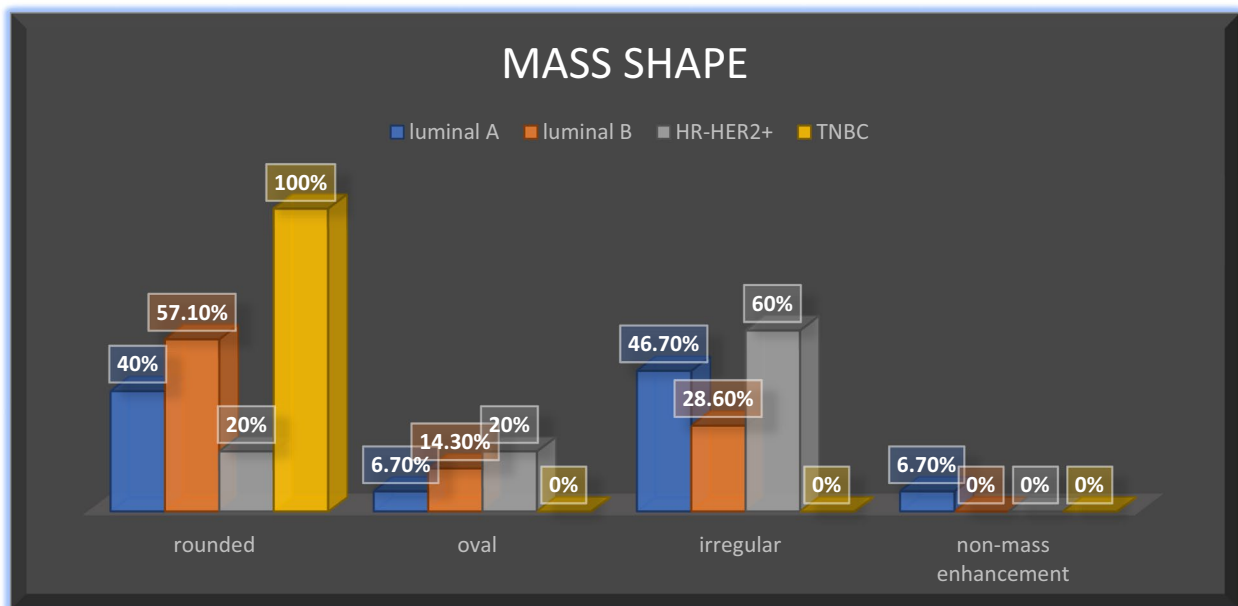

Fig. 4 Mass shapes among different molecular subtypes. Forty percent of HR-positive tumors were rounded, compared to 57.1% in luminal B tumors, 20% in HER2-enriched tumors, and 100% in TNBC

difference ($P=0.044$). Consistent with Johnson et al. [5], who said that luminal A and B tumors often present with spiculated margins.

Boria et al. [26] also found that positive ER and PR expression was correlated with spiculated margins ($P=0.001$), indicating a good prognostic factor. The study of Algazzar et al. [27] showed that when compared to HR-positive breast cancers, HR-negative breast tumors had a much higher likelihood of presenting with circumscribed margins (46.2% vs. 8.3%, respectively).

Not-circumscribed margins are mostly associated with luminal breast cancer, which is explained by the lack of desmoplastic reaction and the relatively slow growth rate [17].

As far as we're able to tell, in our study, we present the first evidence linking MRI mass border type with subsequent surgical intervention ($P=0.030$). We found that 83.3% of patients with a speculated border underwent MRM, 75% with an irregular border underwent MRM, and all patients with a well-defined mass border underwent BCS. This may be explained by the attention of our surgeons to achieve a negative surgical margin.

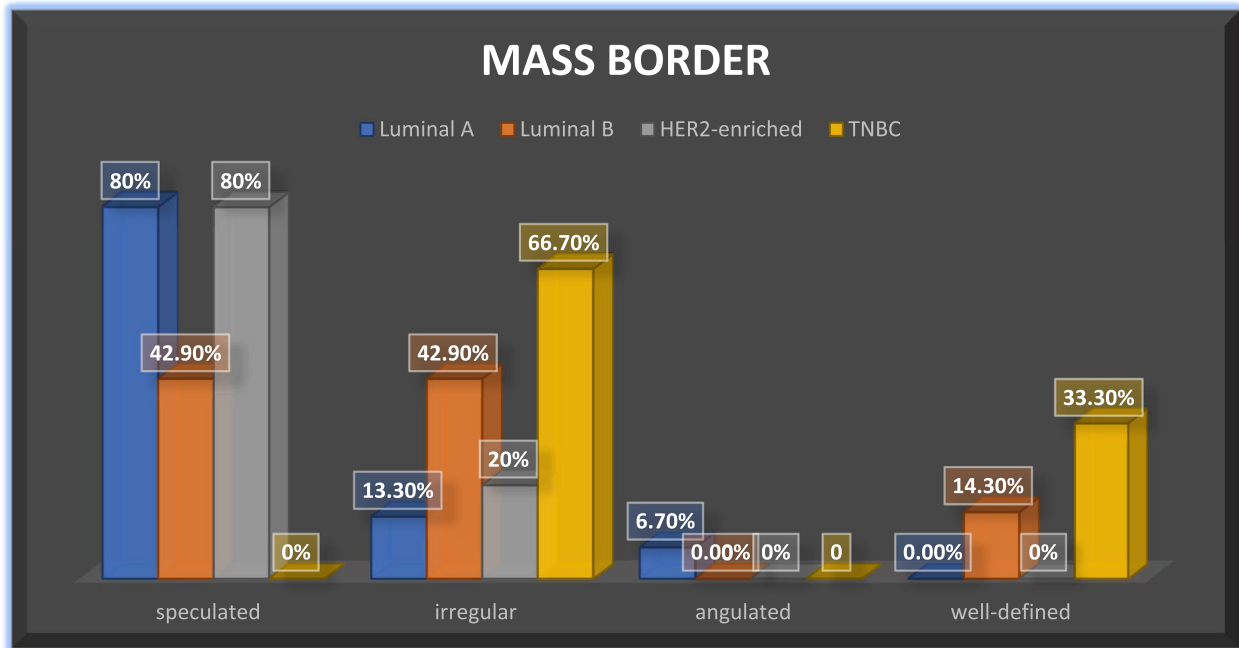One unanticipated finding in this study was that there was an insignificant difference between molecular

Fig. 5 Mass borders among different molecular subtypes. Eighty percent of HR-positive tumors were spiculated, compared to 42.9% in luminal B tumors and 80% in HER2-enriched tumors
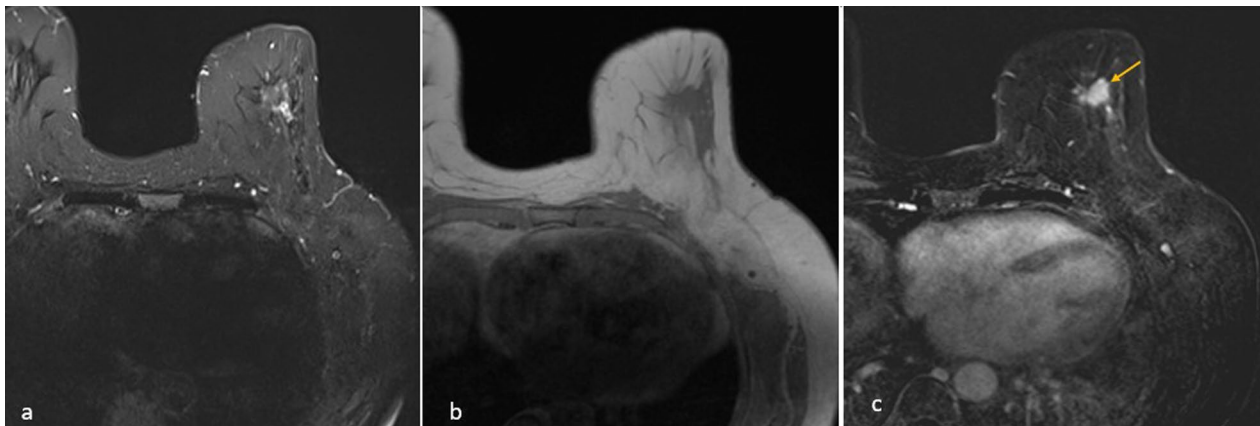

Fig. 6 A 58-year-old female patient, presented clinically with left breast cancer. Initial MRI revealed unifocal mass in lower outer quadrant of the left breast with irregular shape, speculated border and equivocal level I lymph nodes. Pathological analysis revealed IDC, G 2, ER+, PR+, HER 2 neu. **a** T2W1, **b** T1W1, **c** contrast-enhanced T1W1

subtypes and tumor size ($P = 0.602$), lymph nodes ($P = 0.283$), multicentricity ($P = 0.386$), and curve type ($P = 0.107$). A possible explanation for this might be the comparatively low number of individual patients participating in our study. This contradicted the findings of Galati et al. [28], who stated that the absence of axillary adenopathy was significantly associated with luminal A-like tumors which confirmed that this BC subtype is characterized by less aggressive behavior and a better

prognosis. They also discovered a significant correlation between cancers with a luminal A subtype and lesion sizes smaller than 2 cm. Consistent with our results, they found no statistical association between tumor size assessed by MRI and other molecular subtypes.

In the study of Ozturk et al. [29], there was a significant difference in the frequency of axillary lymph node metastases among the various subtypes of breast cancer ($P = 0.039$). Although multifocality and multicentricity

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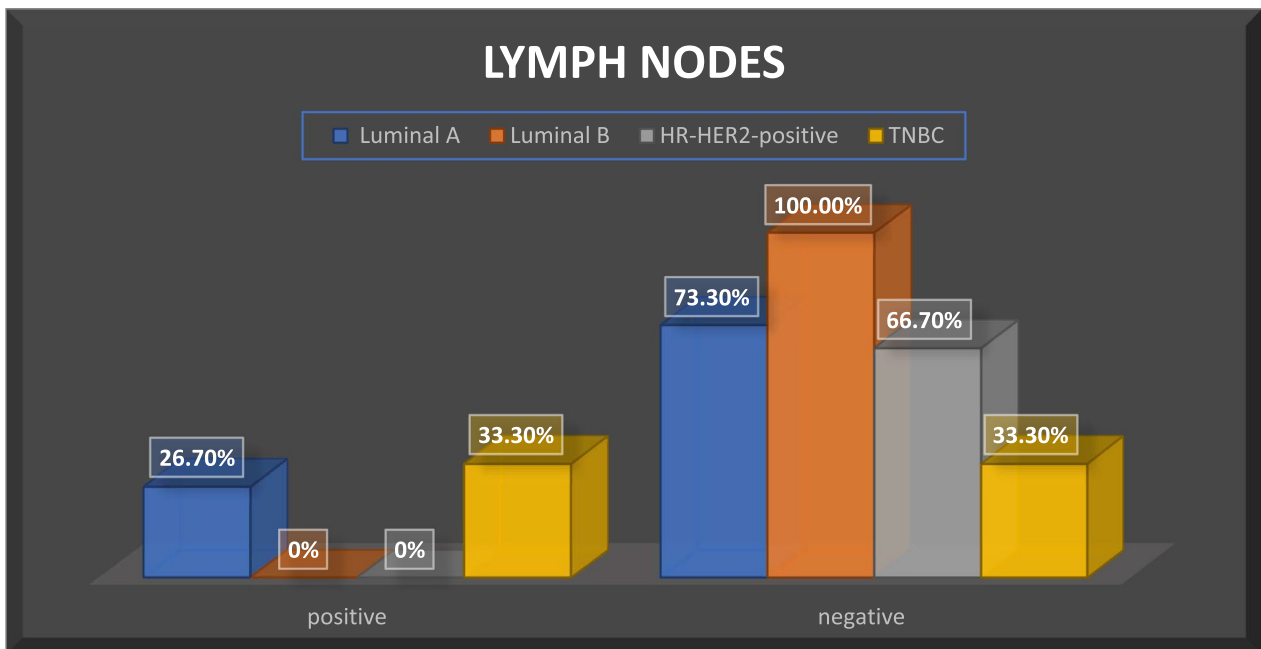
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Fig. 7 Lymph nodes among different molecular subtypes. Seventy-three and three-tenths percent of HR-positive tumors had positive lymph nodes, compared to 33.3% in TNBC and 100% in HER2-positive tumors

Fig. 8 A 41-year-old female patient, presented clinically with left breast cancer. Initial MRI revealed: unifocal mass in the upper inner quadrant of the left breast with an irregular shape, speculated border and pathological level I and II lymph nodes. Pathological analysis revealed IDC, grade (G) 2, ER+, PR+, and HER 2 neu+. **a** T2W1, **b** T1WI, **c** contrast-enhanced T1WI

were observed more frequently in the luminal and HER2 (+) subtypes than in the TN group, the difference did not meet the criteria for statistical significance, as indicated by our findings. In addition, the study could not find any statistically significant correlation between different molecular subtypes and tumor size ($P = 0.14$).

Youk et al. [30] study indicated that the node-positive rate was not different among subtypes in this study ($P = 0.807$), but tumor size was significant with them ($P < 0.0001$). Navarro et al. [31] evaluated MR imaging findings in molecular subtypes of breast cancer and found that tumor size and axillary lymph node positivity are not significantly correlated with molecular subtypes ($P = 0.205$, $P = 0.474$, respectively). Navarro et al. [31] also found that there were no statistically significant differences between the dynamic curve type in MRI and the different subtypes ($P = 0.607$). Unsimilar to our results, Algazzar et al. [27] found that HR-negative breast cancers were significantly associated with type III kinetic curves ($p = < 0.001$).
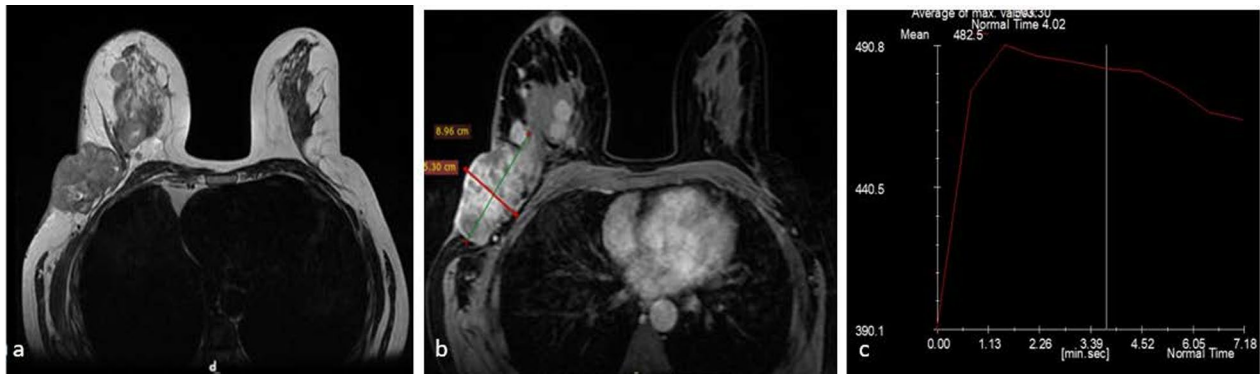
Fig. 9 A 43- year-old female patient, presented clinically with right breast cancer. Initial MRI revealed multicentric masses, rounded shape, irregular border, and mainly axillary tail mass infiltrating the chest wall. Pathological axillary lymph node infiltrating the lateral pectoral margins. Pathological analysis revealed IDC, G2, ER+, PR+, and HER 2 neu+. **a** T1WI, **b** contrast-enhanced T1WI, **c** type III curve

Table 3 MRI morphological features stratified by molecular subtypes

Morphological features	Molecular subtypes				P value
	Luminal A (n = 15)	Luminal B (n = 7)	HR-HER2 positive (n = 5)	TNBC (n = 3)	
	N (%)	N (%)	N (%)	N (%)	
Mass shape					
Round	6 (40%)	4 (57.1%)	1 (20%)	3 (100%)	0.098
Oval	1 (6.7%)	1 (14.3%)	1 (20%)	0 (0%)	0.345
Irregular	7 (46.7%)	2 (28.6%)	3 (60%)	0 (0%)	0.112
Non-mass enhancement	1 (6.7%)	0 (0%)	0 (0%)	0 (0%)	1.00
Mass border					
Speculated	12 (80%)	3 (42.9%)	4 (80%)	0 (0%)	0.023*
Irregular	2 (13.3%)	3 (42.9%)	1 (20%)	2 (66.7%)	0.188
Angulated	1 (6.7%)	0 (0%)	0 (0%)	1 (33.3%)	0.161
Well-defined	0 (0%)	1 (14.3%)	0 (0%)	0 (0%)	1.00
Multicentricity					
Unicentric	4 (26.7%)	2 (28.6%)	2 (66.7%)	3 (60%)	0.386
Multicentric	11 (73.3%)	5 (71.4%)	1 (33.3%)	2 (40%)	
Tumor size					
T1	0 (0%)	1 (14.3%)	1 (20%)	0 (0%)	0.602
T2	9 (60%)	3 (42.9%)	3 (60%)	1 (33.3%)	
T3	3 (20%)	0 (0%)	0 (0%)	1 (33.3%)	
T4	3 (20%)	3 (42.9%)	1 (20%)	1 (33.3%)	
Lymph nodes					
Positive	4 (26.7%)	0 (0%)	0 (0%)	1 (33.3%)	0.283
Negative	11 (73.3%)	7 (100%)	5 (100%)	2 (66.7%)	

*chi-square test—one way ANOVA

Limitations

However, our research had a few limitations. This is a single-center study that only had a limited number of participants overall. The study didn't include all possible patients, as they underwent excisional biopsy before MRI. Furthermore, the limited patient population made the distribution of molecular subtypes unbalanced. The cost of an MRI examination was high

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Table 4 Some morphological MRI features stratified by type of surgery (*N* = 29)

Parameters	Total	Type of surgery		P value
		BCS (n = 8)	MRM (n = 21)	
		N (%)	N (%)	
Mass shape				
Round	14	5 (35.7%)	9 (64.3%)	0.575
Oval	3	0 (0%)	3 (100%)	
Irregular	11	3 (27.3%)	8 (72.7%)	
Non-mass enhancement	1	0 (0%)	1 (100%)	
Mass border				
Speculated	18	3 (16.7%)	15 (83.3%)	0.030*
Irregular	8	2 (25%)	6 (75%)	
Angulated	2	2 (100%)	0 (0%)	
Well-defined	1	1 (100%)	0 (0%)	
Multicentricity				
Unicentric	11	4 (36.4%)	7 (63.6%)	0.408
Multicentric	18	4 (22.2%)	14 (77.8%)	

*Chi-square test

in our ongoing department. Finally, MRI images were evaluated by only one radiologist.

Conclusions

MRI morphological features could help in forecasting the molecular subtypes of breast cancer. There was a statistically significant difference between different molecular subtypes and the speculated mass border. There was a statistically significant difference between the type of breast cancer surgery and the mass border. Therefore, MRI breast imaging has an important role in diagnostic and prognostic settings. We may recommend incorporation in multicenter studies. We also recommend further research on the relationship between the findings of MRI and high-penetrance susceptibility genes in breast cancer in the era of radiogenomics and personalized medicine.

Abbreviations
MRI	Magnetic resonance imaging
TNBC	Triple-negative breast cancers
HR	Hormonal receptor
BC	Breast cancer
ER	Estrogen receptor
PR	Progesterone receptor
HER2	Human epidermal growth factor receptor-2
DCE	Dynamic contrast enhancement
DWI	Diffusion-weighted imaging
IDC	Infiltrating duct carcinoma
G	Grade

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