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FULL RESEARCH ARTICLE

Ultrasound features of breast nonmass using a standardized lexicon: prediction of malignancy

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ABSTRACT

Introduction: *A breast nonmass (NM) on ultrasound (US) is associated with a wide spectrum of breast pathologies. The aims of this study were to (1) re-evaluate the ultrasonographic features of breast NM using a standardized lexicon and (2) identify the ultrasonographic features that predict malignancy in NM and its histopathologic confirmation.* **Material and Methods:** *Women with ultrasonographic report of breast NM with BI-RADS category 3, 4, or 5 and diagnosis by biopsy or ultrasonographic follow-up over 24 months were included. The following features of breast NM were assessed by ultrasound: echogenicity, distribution, orientation, and associated findings according to the standardized lexicon of the fifth-edition update of the ACR BI-RADS. Univariate and multivariate analyses were performed.* **Results:** *Seventy-two women with breast NM were included; 53 (73.6%) had confirmed benign NM, 3 (4.2%) had benign with upgrade potential (BWUP) NM, and 16 (22.2%) had malignant NM. Significant ultrasonographic findings predictive of malignant NM were echogenic rind (OR 12.66, 95% CI 2.08 - 76.83), hypervascularity (OR 7.96, 95% CI 1.71 - 37.02), and calcifications (OR 18.61, 95% CI 2.71-127.65) with sensitivity of 75.0% (95% CI, 50.5 - 89.8%), specificity of 96.1% (95% CI, 86.8-98.9), PPV of 85.7% (95% CI, 60.1-96.0), and NPV of 92.5% (95% CI, 82.1-97.0). The accuracy for diagnosing malignant breast NM was 91.0% (95% CI, 81.8-95.8%).* **Conclusion:** *The ultrasonographic features of breast NM were defined using a standardized lexicon. Malignant breast NM was diagnosed in one out of four women. The predictive ultrasound findings were echogenic rind, hypervascularity, and calcifications. In breast NMs, a biopsy is recommended to confirm the diagnosis.*

Keywords: *Ultrasound. BI-RADS. Breast nonmass. Nonmass lesion. Standardized lexicon. Breast carcinoma.*

INTRODUCTION

A breast nonmass (NM) includes a wide spectrum of benign, benign with upgrade potential (BWUP), or malignant pathologies[1,2]. NM ultrasound findings associated with breast malignancy include architectural distortion, hypervascularity, and calcifications[1,3-6]. Ductal carcinoma in situ and invasive lobular carcinoma can present as breast NM,[4,7,8] and are the most frequent diagnoses associated with malignant etiology[1,9,10].

The ultrasonographic features of breast NM vary. They are often as hypoechoic area, architectural distortion, asymmetry, or focal asymmetry[1,4-8,11,12]. Breast NM lacks the 3-dimensionality of a mass: is identifiable in at least 2 planes but may be primarily visualized in 1 plane only. Lacks definable shape and margin for assessment[13]. The American College of Radiology Breast Imaging Reporting and Data System (ACR BI-RADS) proposed standardized terminology to describe NMs detected on breast ultrasound (US)[13].

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It includes ultrasonographic features of echogenicity, distribution, orientation, and associated findings (echogenic rind, architectural distortion, posterior shadowing, hypervascularity, ductal extension or abnormal ductal changes, and calcifications)[13]. The aims of this study were to (1) re-evaluate the ultrasonographic features of breast NM using a standardized lexicon proposed in the fifth-edition update of the ACR BI-RADS, and (2) identify ultrasonographic features that predict malignant NM.

MATERIAL AND METHODS

This cross-sectional study was conducted from January 2016 to December 2022 in the Breast Imaging Department of Hospital San Javier in Guadalajara, Jalisco, Mexico. Women with ultrasonographic report of breast NM and diagnosis by histopathologic examination or 24-month follow-up with breast US were included. Women with BI-RADS 6 were excluded. Informed consent was not required for the use of data collected during routine clinical care. This study was approved by institutional ethics and research committees.

Study development and variables

Ultrasound examinations of breast NM cases with a report based on findings such as hypoechoic, architectural distortion, asymmetry, and/or focal asymmetry

Table 1. Etiologic diagnosis of breast NMs with histopathologic confirmation or stability by US examination at 24-month follow-up

Benign breast NM	n (%)
Fibrocystic changes	11 (20.7)
Fibroadenomatoid changes	6 (11.3)
Fibroadenoma	5 (9.4)
Sclerosing adenosis	4 (7.5)
Adenosis	2 (3.8)
Radial scar	2 (3.8)
Chronic granulomatous mastitis	1 (1.9)
Tuberculosis	1 (1.9)
Pseudoangiomatous stromal hyperplasia	1 (1.9)
Stromal fibrosis	1 (1.9)
Benign for stability	19[a] (35.9)
Total	53 (100)
BWUP breast NM	**n (%)**
Atypical ductal hyperplasia	2 (66.6)
Focal papillomatosis	1 (33.4)
Total	3 (100)
Malignant breast NM	**n (%)**
Invasive ductal carcinoma	10 (62.4)
Ductal carcinoma in situ	4 (25.0)
Invasive lobular carcinoma	1 (6.3)
Paget's disease associated with invasive ductal carcinoma	1 (6.3)
Total	16 (100)

[a]In 19 patients the lesion was stable by breast US examination at 24-month follow-up, and no biopsy was performed; BI-RADS: Breast Imaging- Reporting and Data System; NM: nonmass; BWUP: benign with upgrade potential.

Table 2. Comparison of breast NM diagnosis by age, purpose of US examination, and BI-RADS categories

Description	Benign breast NM n = 53 (73.6%)	BWUP breast NM n = 3 (4.2%)	Malignant breast NM n = 16 (22.2%)	Total n = 72 (100%)	p-value
Age, years, mean ± SD	44.7 ± 11.08	53.2 ± 16.34	51.1 ± 11.04	46.7 ± 11.73	0.068
min, med, max	(21, 44, 69)	(40, 49, 81)	(34, 51, 70)	(21, 45, 81)	
Age groups					0.295
< 52 years	40 (75.4)	1 (33.3)	9 (56.3)	50 (69.4)	
≥ 52 years	13 (24.6)	2 (66.7)	7 (43.7)	22 (30.6)	
Purpose of the US examination					0.563
Screening	32 (60.4)	2 (66.7)	9 (56.3)	43 (59.7)	
Diagnostic	21 (39.6)	1 (33.3)	7 (43.7)	29 (40.3)	
BI-RADS Category					< 0.001
BI-RADS 3	9 (17.3)	0	0	9 (12.5)	
BI-RADS 4A	13 (25.5)	1 (33.3)	0	14 (19.4)	
BI-RADS 4B	22 (41.5)	2 (66.7)	2 (12.5)	26 (36.1)	
BI-RADS 4C	7 (13.7)	0	6 (37.5)	13 (18.1)	
BI-RADS 5	2 (2.0)	0	8 (50.0)	10 (13.9)	

US: ultrasound; BI-RADS: Breast Imaging- Reporting and Data System; min: minimum; med: medium; max: maximum; NM: nonmass; BWUP: benign with upgrade potential.

Table 3. Comparison of breast US features between benign, BWUP and malignant breast NMs based on a standardized lexicon[a]

Description	Benign breast NM n = 53 (73.6%)	BWUP breast NM n = 3 (4.2%)	Malignant breast NM n = 16 (22.2%)	Total n = 72 (100%)	p-value
Echogenicity					0.117
Hypoechoic	33 (62.3)	2 (66.7)	8 (50.0)	43 (59.7)	
Isoechoic	1 (1.9)	1 (20.0)	0	2 (2.8)	
Hyperechoic	1 (1.9)	0	2 (12.5)	3 (4.2)	
Mixed echogenicity	18 (33.9)	0	6 (37.5)	24 (33.3)	
Distribution					0.210
Regional	12 (22.6)	0	5 (31.3)	17 (23.6)	
Focal	38 (71.6)	3 (100)	8 (50.0)	49 (68.1)	
Linear	2 (3.8)	0	0	2 (2.7)	
Segmental	1 (2.0)	0	3 (18.7)	4 (5.6)	
Orientation					0.372
Parallel	22 (41.6)	1 (33.3)	9 (56.3)	32 (44.4)	
Antiparallel	31 (58.4)	2 (66.7)	7 (43.7)	40 (55.6)	
Echogenic rind					0.015
Yes	11 (20.8)	0	9 (56.0)	20 (27.8)	
No	42 (79.2)	3 (100)	7 (44.0)	52 (72.2)	
Architectural distortion					0.280
Yes	27 (50.9)	3 (100)	12 (75.0)	42 (58.3)	
No	26 (49.1)	0	4 (25.0)	30 (41.7)	
Posterior shadowing					0.439
Yes	34 (64.1)	1 (33.3)	13 (81.3)	48 (66.7)	
No	19 (35.9)	2 (66.7)	3 (18.7)	24 (33.3)	
Hypervascularity					< 0.001
Yes	11 (20.8)	1 (33.3)	11 (68.7)	23 (31.9)	
No	42 (79.2)	2 (66.7)	5 (31.3)	49 (68.1)	
Ductal extension or abnormal ductal change					0.169
Yes	3 (5.7)	0	3 (18.7)	6 (8.3)	
No	50 (94.3)	3 (100)	13 (81.3)	66 (91.7)	
Calcifications					0.002*
Yes	5 (9.5)	0	8 (50.0)	13 (18.1)	
No	48 (90.5)	3 (100)	8 (50.0)	59 (81.9)	

US: ultrasound; NM: nonmass; BWUP: benign with upgrade potential. [a] Newell MS, Destounis S, Leung J, DeMartini W, Eby P. BI-RADS update: The edition formerly known as the 5th. Reston VA. USA. American College of Radiology (ACR); 2021.

classified as BI-RADS 3, 4A, 4B, 4C, and 5 were retrospectively reviewed. Histopathologic confirmation by breast biopsy or follow-up with breast US at 24 months was used to define stability. Images were obtained from PACS (Picture Archiving and Communication System) (Carestream TM, Health Inc, version 12.1.5, Rochester, NY, USA). Age and reason for the US examination (screening or diagnosis) were recorded.

Ultrasound acquisition and analysis

Ultrasound examinations were performed with an Aloka ultrasound system (Hitachi Co. Metzingen, Germany) with a 10-16 MHz multifrequency linear transducer in gray-scale, color Doppler, and power Doppler imaging. The evaluation was performed by a specialized radiologist (JPV) with 10 years of experience in breast imaging.

Table 4. Univariate analysis of significant ultrasonographic features comparing benign and malignant breast NM

Description	Benign breast NM (n = 53)	Malignant breast NM (n = 16)	p-value	OR (95% CI)
Echogenic rind, n (%)	11 (20.8)	9 (56.0)	0.009	5.27 (1.58-17.60)
Hypervascularity, n (%)	11 (20.8)	11 (68.7)	< 0.001	9.02 (2.55-31.90)
Calcifications, n (%)	5 (9.5)	8 (50.0)	0.001	9.20 (2.39-35.35)

NM: nonmass; OR: odds ratio; CI: confidence interval.

Table 5. Multivariate analysis of significant ultrasonographic features predicting malignant breast NM

Description	p-value	OR (95% CI)
Echogenic rind	0.006	12.66 (2.08-76.83)
Hypervascularity	0.008	7.96 (1.71-37.02)
Calcifications	0.003	18.61 (2.71-127.65)

NM: nonmass; OR: odds ratio; CI: confidence interval.

Table 6. Diagnostic performance of the three significant ultrasonographic features[a] predicting malignant breast NM

Parameter	%	95% CI
Sensitivity	75.0	50.5-89.8
Specificity	96.1	86.8-98.9
PPV	85.7	60.1-96.0
NPV	92.5	82.1-97.0
Accuracy	91.0	81.8-95.8

[a]Echogenic rind, hypervascularity and calcifications; CI: confidence interval; NPV: negative predictive value; PPV: positive predictive value; NM: nonmass.

The ultrasonographic features of breast NM included in the standardized lexicon of the updated ACR-BI-RADS fifth-edition[13] were echogenicity (hypoechoic, isoechoic, hyperechoic, or mixed), distribution (regional, focal, linear, or segmental), orientation (parallel or antiparallel), and associated findings (echogenic rind, architectural distortion, posterior shadowing, hypervascularity, ductal extension or abnormal ductal changes and calcifications).

Statistical analysis

The mean, standard deviation, minimum, median, and maximum of age was reported and ANOVA was calculated to compare the mean age between pathologic diagnoses of breast NM. Fisher's exact test was used to compare the frequency of ultrasonographic features suspicious for malignancy and histopathologic confirmation. Univariate odds ratio (crude OR) with a 95% confidence interval and a multivariate binary logistic regression were calculated to identify significant independent variables predictive of malignant breast NM. Sensitivity, specificity, positive predictive value, negative predictive value, false positive rate, false negative rate, and accuracy for predicting malignant breast NM were determined using significant ultrasonographic features in the logistic regression analysis. A p-value < 0.05 was considered significant. IBM-SPSS Version 25 (IBM Co. Armonk, NY, USA) was used for data analysis.

RESULTS

Seventy-two women with breast NM were included. Table 1 describes the diagnoses and histopathologic confirmation. The most common diagnoses of benignity were fibrocystic changes in 11 (20.7%), fibroadenomatoid changes in 6 (11.3%), fibroadenoma in 5 (9.4%), and sclerosing adenosis in 4 (7.5%). In 19 (35.9 %) cases benign breast NM was defined based on the 24-month follow-up US. Other less common benign histopathologic diagnoses are shown in Table 1. BWUP histopathologic diagnosis was made in three NM cases; two with atypical ductal hyperplasia, and one with focal papillomatosis. The most common diagnosis in the malignant NM group was invasive ductal carcinoma (n = 10, 62.4%) and ductal carcinoma in situ (n = 4, 25.0%). Other less common diagnoses were invasive lobular carcinoma (n = 1, 6.3%) and Paget's disease (n = 1, 6.3%).

Table 2 compares the age, reason for breast US, and BI-RADS category of the 72 women. There were 53 (73.6%) women with benign breast NM, 3 (4.2%) with BWUP breast NM, and 16 (22.2%) with malignant breast NM. Malignant etiology was found in approximately in 1 of 4 women with a breast NM. There were no significant differences in age for malignant NM in women younger, equal, or older than 52. Breast US screening was performed in 32 (60.4%) of 72 women. Malignant NMs were significantly associated with higher BI-RADS categories: BI-RADS 4B (n = 2, 12.5%),

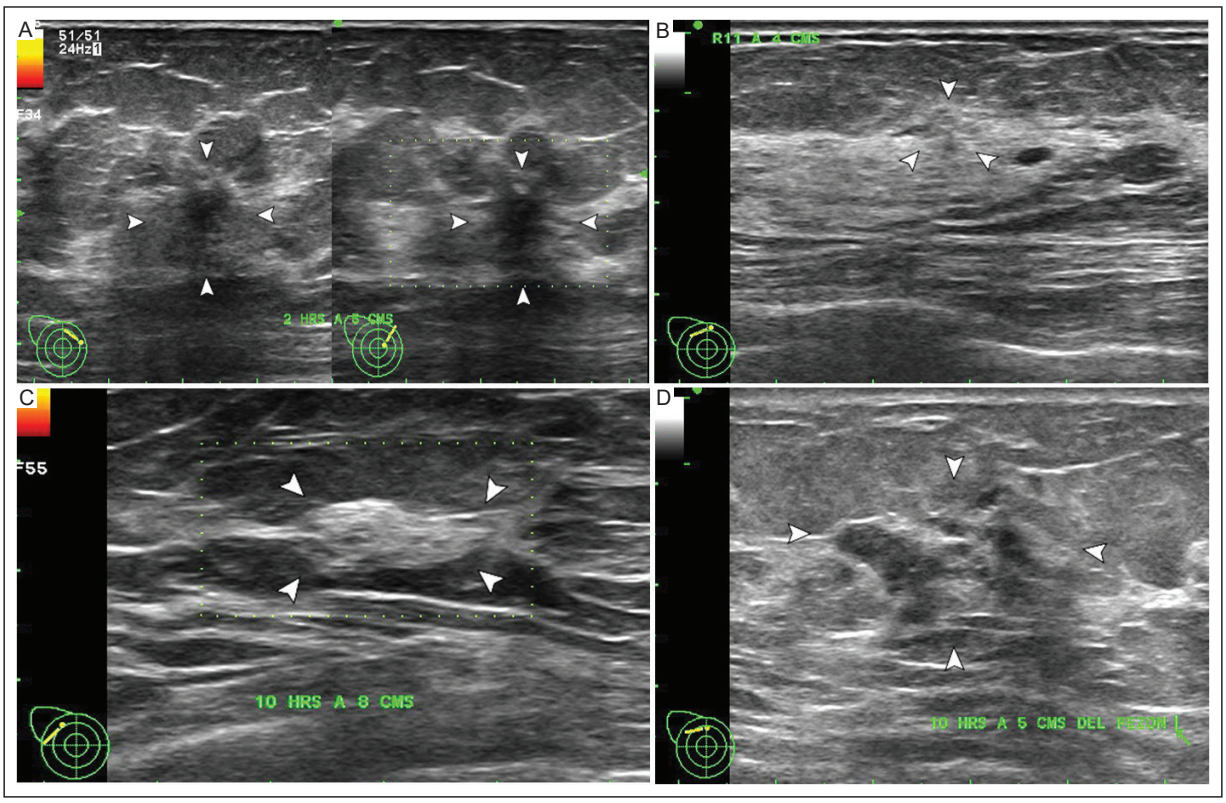

Figure 1. US in grayscale and power Doppler showing the **echogenicity** of breast NM. **A:** hypoechoic (arrowheads). **B:** isoechoic (arrowheads). **C:** hyperechoic (arrowheads). **D:** mixed echogenicity (arrowheads).

NM: nonmass; US: ultrasound.

BI-RADS 4C (n = 6, 37.5%), and BI-RADS 5 (n = 8, 50.0%), in contrast to benign NMs in categories 4B (n = 22, 41.5%), BI-RADS 4C (n = 7, 13.7%), and BI-RADS 5 (n = 2, 2.0%) (p < 0.001).

The ultrasonographic features of benign, BWUP, and malignant breast NMs are compared in Table 3. Echogenic rind (p = 0.015), hypervascularity (p < 0.001), and calcifications (p = 0.002) were more frequent in malignant breast NMs. There were no significant differences in echogenicity, distribution, orientation, posterior shadowing, or ductal changes between the three groups. Figure 1 shows the echogenicity features of the breast NM (hypoechoic, isoechoic, hyperechoic, and mixed echogenicity), Figure 2 the distribution features (regional, focal, linear, and segmental), and Figure 3 the orientation features (parallel and antiparallel). The associated findings (echogenic rind, architectural distortion, posterior shadowing, hypervascularity, ductal extension or abnormal ductal change, and calcifications) are shown in Figure 4. Figure 5 shows two cases of benign breast NM with histopathologic diagnosis of simple and sclerosing adenosis. Figure 6 shows one case of BWUP breast NM with histopathologic diagnosis of atypical ductal hyperplasia. Figure 7 shows two cases of malignant breast NM with histopathologic diagnosis of invasive ductal carcinoma and ductal carcinoma in situ.

In the univariate analysis (Table 4) and multivariate binary logistic regression (Table 5), we compared breast NM with benign and malignant diagnosis. Echogenic rind (OR 12.66, 95% CI 2.08-76.83), hypervascularity (OR 7.96, 95% CI 1.71-37.02), and calcifications (OR 18.61, 95% CI 2.71-127.65) were significantly associated with the risk of malignant breast NMs.

Regarding the diagnostic performance of the three significant ultrasonographic features predicting malignant breast NMs (echogenic rind, hypervascularity, and calcifications) (Table 6), sensitivity was 75% (95% CI, 50.5-89.8%), specificity 96.1% (95% CI, 86.8-98.9), positive predictive value 85.7% (95% CI, 60.1-96.0), negative predictive value 92.5% (95% CI, 82.1-97.0), and accuracy 91.0% (95% CI, 81.8-95.8%). There were false-positive results in 2 (3.8%, 95% CI, 1.1-13.2) of 53 cases with benign breast NM and false-negative results in 4 (25.0%, 95% CI, 10.2-49.5) of 16 cases with malignant breast NM.

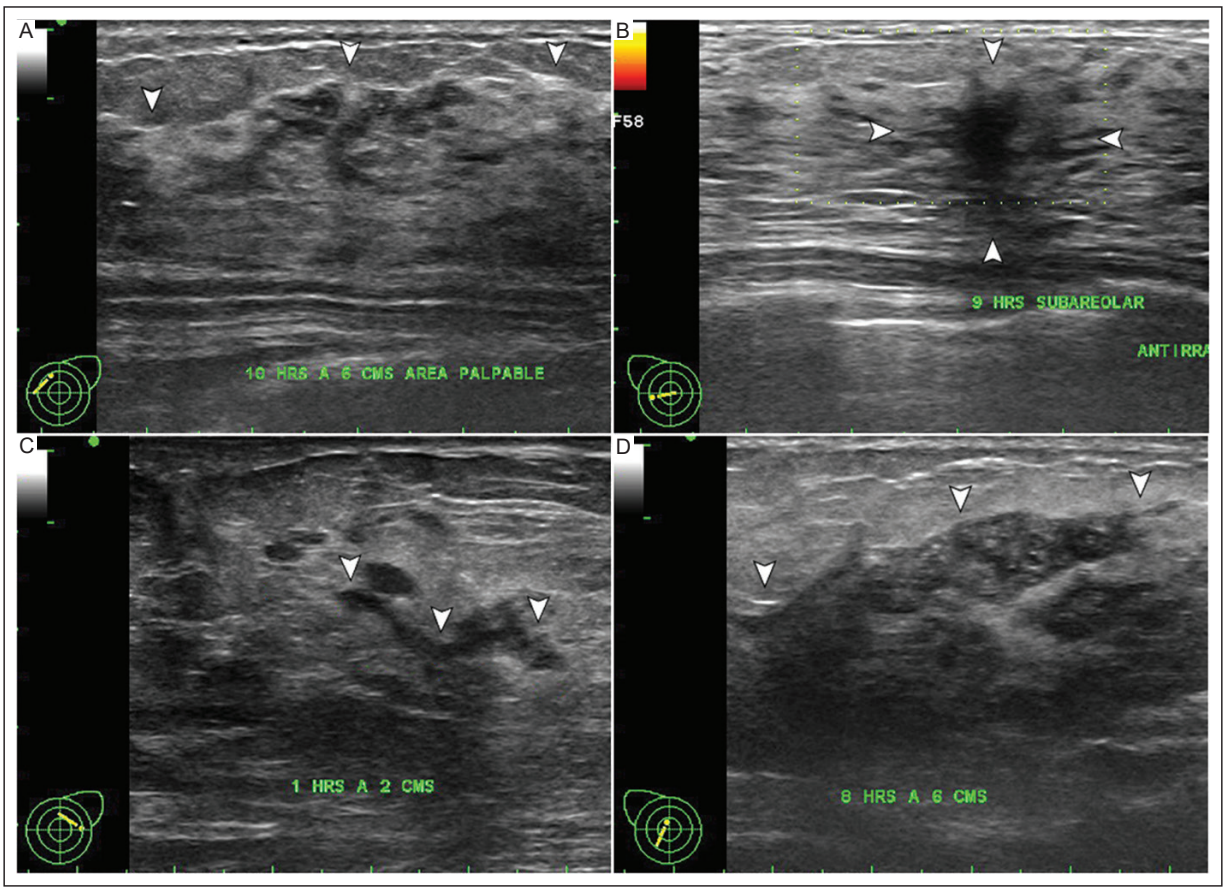

Figure 2. US in grayscale and power Doppler showing the **distribution** of breast NM **A:** regional (arrowheads). **B:** focal (arrowheads). **C:** linear (arrowheads). **D:** segmental (arrowheads).

NM: nonmass; US: ultrasound.

DISCUSSION

In our study, we found that the presence of echogenic rind, hypervascularity, and calcifications were ultrasonographic features that predicted malignancy in breast NM. These three features have high diagnostic accuracy; however, their absence may be a false-negative result. Therefore, we recommend breast biopsy in all patients with a breast NM. The use of the standardized breast US lexicon provided by the ACR BI-RADS fifth-edition update is useful for accurately describing breast NM and may allow systematizing management and follow-up.

Breast carcinoma can present as breast NM with different features on US. Lin et al.[14] reported an incidence of malignant NM of 4.59% (47/1024). Park et al.[6] found 88 (72.7%) cases of benign NM and 33 (27.3%) malignant NM cases in a retrospective study of 121 patients. Ductal carcinoma in situ (17/33, 51.5%) and invasive ductal cancer with or without ductal carcinoma in situ (13/33, 39.4%) were the main malignancies. These results are comparable to our study, in which malignant breast NM was detected in 16 (22.2%) of 72 women. In contrast, invasive ductal cancer was more frequent in our cases (n = 10, 62.4%). Ultrasonographic findings that predict malignant breast NMs were echogenic rind (OR 12.66, 95% CI 2.08-76.83), hypervascularity (OR 7.96, CI 1.71-37.02), and calcifications (OR 18.61, CI 2.71-127.65). On the other hand, in a retrospective study of 715 women[15] the significant US features associated with malignancy were segmental distribution (OR 3.03, 95% CI 1.50-6.15), calcifications (OR 4.26, 95% CI, 1.62-11.18), abnormal ductal changes (OR 4.91, 95% CI, 2.07-11.68), and posterior shadowing (OR 20.20, 95% CI, 6.46-63.23). Lin et al.[14] reported that microcalcifications and posterior shadowing were associated with malignant breast NM in 59 women. The ultrasonographic features that were significant for malignancy in our study may support the suspicion of malignant breast NM.

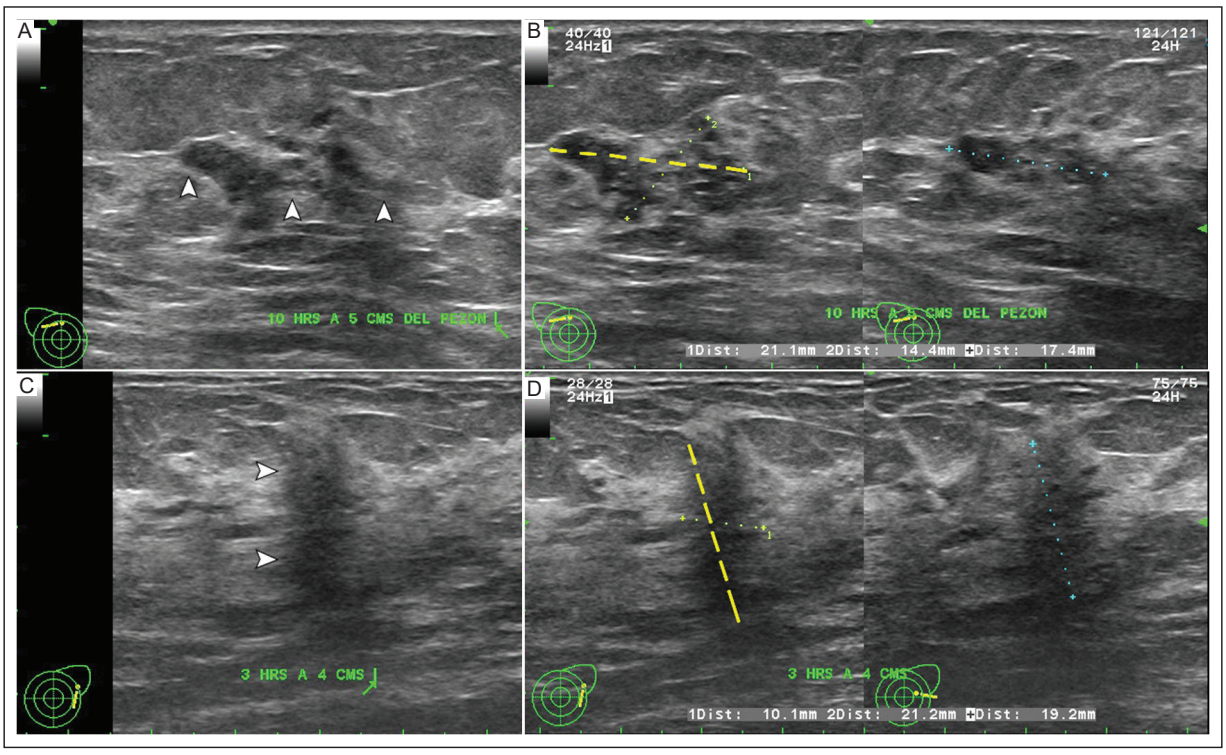

Figure 3. US in grayscale shows the **orientation** of breast NM. **A:** parallel (arrowheads), **B:** the 21-mm maximum axis (yellow line) of the lesion is shown parallel to the skin plane, **C:** antiparallel (arrowheads), and **D:** the 21.2-mm long maximal axis is in the anteroposterior plane (yellow line).

NM: nonmass; US: ultrasound.

The likelihood of malignancy in some breast NMs is underestimated[14]. The diagnostic accuracy of ultrasound findings in predicting malignant breast NMs has been evaluated. Zhang et al.[16] found a correlation between microcalcifications and malignant breast NMs in a retrospective study of 71 NMs assessed with US. The sensitivity was 100%, specificity was 29%, and accuracy was 69.0%. In our study, echogenic rind, hypervascularity, and calcifications had a sensitivity of 75%, specificity of 96.1%, and accuracy of 91%. The proportion of false negative results in our study population was high (25%); therefore, we cannot rule out malignancy based on breast US features alone. Biopsy of breast NM is recommended to confirm the diagnosis.

BWUP breast lesions are pathologies that increase the risk of subsequent breast malignancy over time[17]. In a systematic review and meta-analysis that included 129 studies, 11423 BWUP breast lesions were evaluated, and 2160 (17%) were found to have malignancy. BWUP breast lesions have different ultrasound features and may present as NM[18]. In our study, 3 (4.2%) of the 72 cases with breast NMs were BWUP cases. The US features of these BWUP breast NMs were predominantly hypoechoic, focal with antiparallel orientation, and architectural distortion. BWUP lesions presenting as breast NM have ultrasonographic features suspicious for malignancy, and biopsy is recommended for histopathologic confirmation.

Benign breast NM occurs in a variable proportion of cases, according to the literature[10,14,18]. Lee et al.[10] reported 95 (1.0%) NM in a retrospective study of 8856 asymptomatic women screened with breast US. Of the 93 lesions that were followed or confirmed histopathologically, 89 (95.6%) were benign, 2 (2.2%) were BWUP, and 2 (2.2%) were malignant breast NMs. Forester et al.[18] studied 166 patients with breast NM and found 104 (62.6%) benign NMs, 33 (19.9%) BWUP lesions, and 29 (17.5%) malignant breast NMs. These results are comparable to our study, in which 53 (73.6%) of 72 cases had benign breast NM. Fibrocystic changes were the most common benign diagnoses (11, 20.7%), similar as reported by other authors[4,8,10]. US features of benign breast NMs were variable, with hypoechoic (n = 33, 62.3%), focal (n = 38, 71.6%), avascular (n = 42, 79.2%), and noncalcified (n = 48, 90.5%) most frequently observed. Radiologists should be familiar with the ultrasonographic findings of

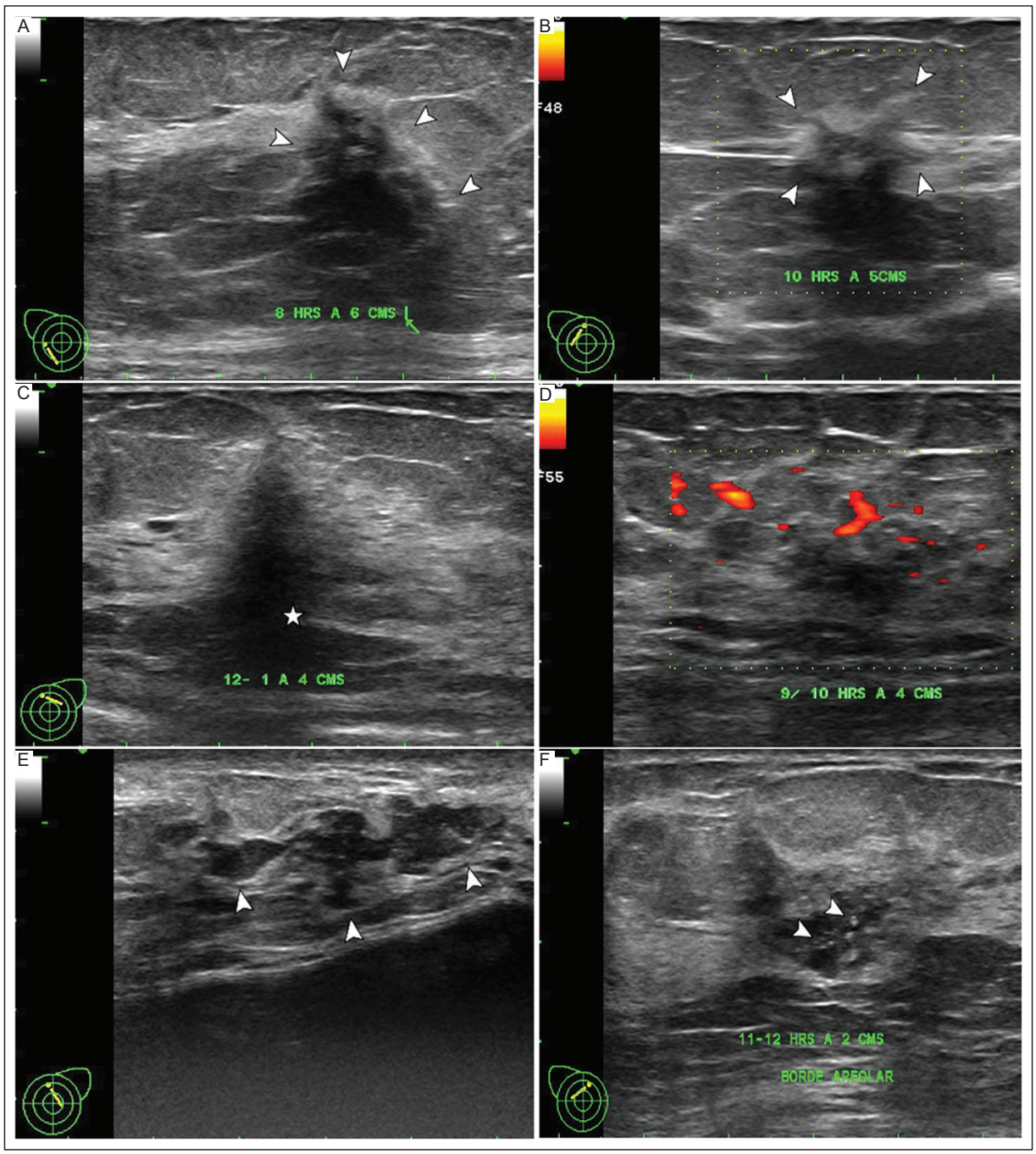

Figure 4. US in grayscale and power Doppler showing **the associated findings** of breast NM. **A:** echogenic rind (arrowheads). **B:** architectural distortion (arrowheads). **C:** posterior shadowing (star). **D:** Breast US power Doppler showing NM with hypervascularity. **E:** ductal extension (arrowheads). **F:** calcifications (arrowheads).

NM: nonmass; US: ultrasound.

benign breast NM to avoid upgrading their category in overestimated malignancy[14].

This study has several strengths. The diagnosis was confirmed in all included cases. The ultrasonographic features of breast NM were defined using a standardized lexicon that provides consistency and systematization to achieve the reproducibility. Some limitations are related to the small sample size and the retrospective design. On the other hand, the breast US was evaluated by only one observer, which may introduce bias due to the subjectivity of a single evaluator. Inter- and intraobserver agreement with the

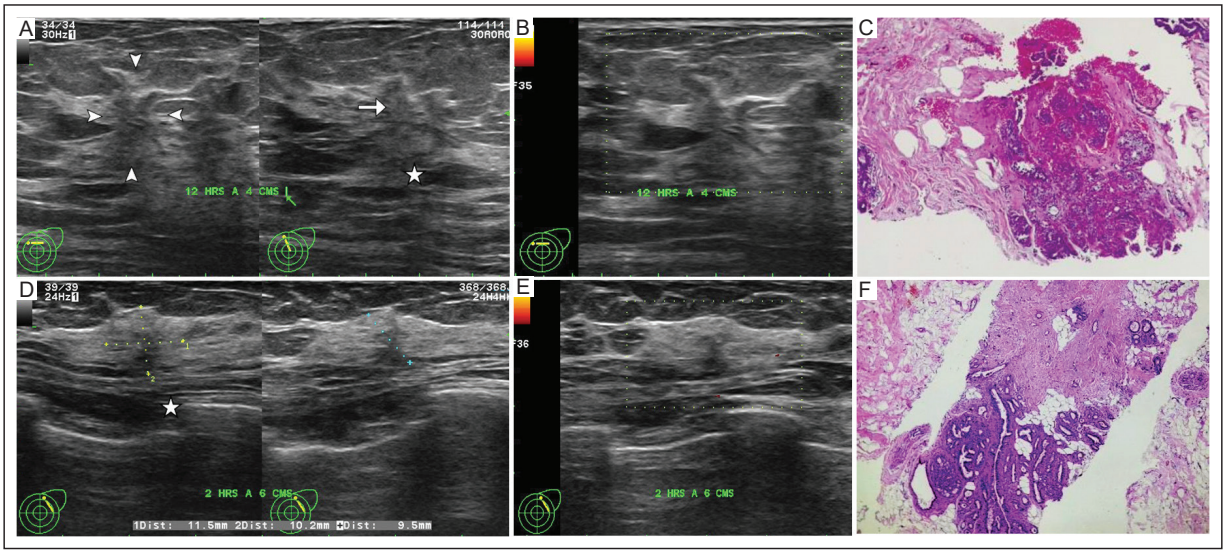

Figure 5. A 55-year-old woman with screening examination. **A:** grayscale US with focal breast NM (arrowheads), mixed echogenicity (arrow), antiparallel with architectural distortion and posterior shadowing (star). **B:** US Doppler power showing avascular breast NM. **C:** CNB. Mild focal proliferation of the small ducts with granular luminal secretion and lining by double row of polygonal, uniform cells without atypia, H&E 100×. Histopathologic diagnosis of simple adenosis. A 43-year-old woman with screening examination. **D:** US in grayscale with focal, hypoechoic, parallel breast NM with architectural distortion and posterior shadowing (star). **E:** US Doppler power showed avascular breast NM. **F:** CNB. Dense fibroelastic stroma with trapped and distorted ducts in an angulated shape with a layer of cubic to flat luminal cells, H&E 100×. Histopathologic diagnosis of sclerosing adenosis.

NM: nonmass; US: ultrasound; CNB: core needle biopsy; H&E: hematoxylin and eosin.

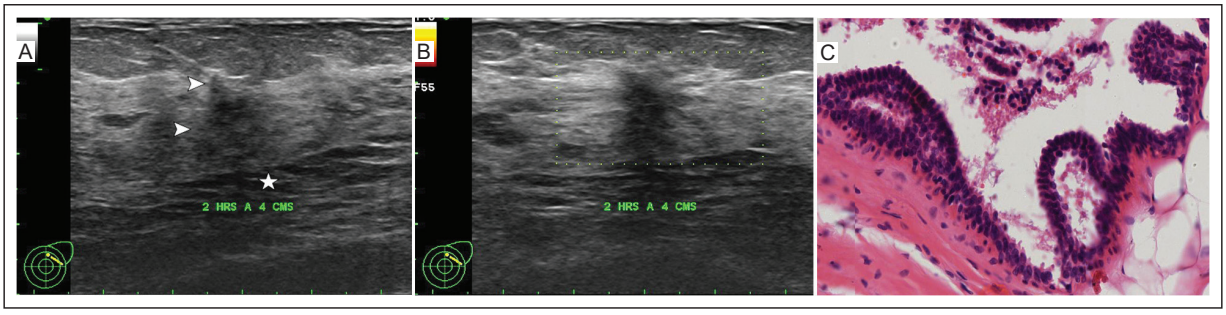

Figure 6. A 78-year-old woman with a routine study. **A:** US in grayscale with breast NM, hypoechoic (arrowheads), and posterior shadowing (star). **B:** US Doppler power showed avascular breast NM. **C:** CNB. Breast tissue with dilated ducts, hyperplasia of luminal cells forming roman bridges and broad-headed papillae. The cells are cylindrical with moderate eosinophilic cytoplasm, the nuclei are monomorphous, round, hyperchromatic, basal and myoepithelial cells are evident H&E, 200×. The histopathologic diagnosis was atypical ductal hyperplasia.

NM: nonmass; US: ultrasound; CNB: core needle biopsy; H&E: hematoxylin and eosin.

standardized breast NM lexicon was not assessed. Elastography, which complements the characterization of breast NM, was not included.

CONCLUSION

In our study, the ultrasonographic features of breast NM were defined using a standardized lexicon. Echogenic rind, hypervascularity, and calcifications were predictors for malignant breast NM. All breast NMs should be considered suspicious for malignancy and classified as category 4. In the presence of predictive features for malignancy, they should be classified at least as category 4B. For all breast NMs, biopsy is recommended for histopathologic confirmation of the diagnosis due to the possibility of malignancy. Interpretation of the ultrasonographic features of breast NM using a standardized lexicon can help radiologists describe them accurately and systematically.

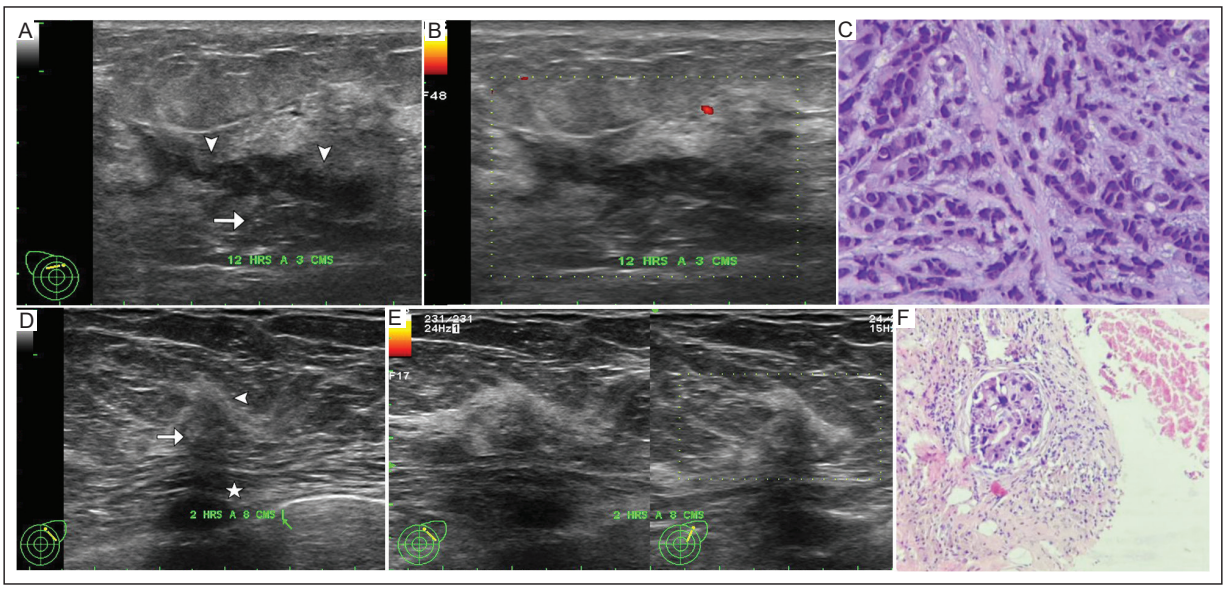

Figure 7. A 34-year-old woman with a screening examination. **A:** US in grayscale showing segmental, hypoechoic, parallel breast NM with echogenic rind, architectural distortion, posterior shadowing, ductal extension (arrowheads), associated with microcalcifications (arrow). **B:** breast US Doppler power with peripheral vascularity. **C:** CNB. Malignant neoplasm of the primary epithelial lineage of the mammary gland composed of nests, cords and tubular formation of less than 5%, H&E 400×. Histopathological diagnosis of invasive ductal carcinoma. A 52-year-old woman with screening examination. **D:** US in grayscale with focal breast NM, mixed echogenicity, antiparallel with echogenic rind (arrowhead), architectural distortion, posterior shadowing (star), associated with microcalcifications (arrow). **E:** US power Doppler shows avascular breast NM. **F:** CNB. Epithelial malignant neoplasm, of ductal origin, with a predominantly solid pattern and scarce glandular formations, located in the mammary ducts, H&E 100×. Histopathological diagnosis of ductal carcinoma in situ.

NM: nonmass; US: ultrasound; BAG: core needle biopsy; H&E: hematoxylin and eosin.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of individuals: this study was conducted according to the Declaration of Helsinki (1964) and its subsequent amendments and the Mexican General Health Law on Research.

Confidentiality of information. The protocol of this hospital center was followed to anonymize patient data.

Right to privacy and informed consent. Informed consent was not required for this retrospective study.

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