

# Breast Ultrasound Reports: Deficiencies and Recommendations

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## Research Article

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# Abstract

**Background:** To investigate the compliance of the reports of the breast ultrasound scanned in different hospitals according to the ACR-BIRADS criteria in terms of their content and results.

**Methods:** 230 breast ultrasound scan reports between 2015-2020 were included in this retrospective study. The health centers were evaluated in four categories as university hospital, training and research hospital, state hospital, private hospital. The reports were evaluated according to the ACR-BIRADS 5th edition (2013) standards in terms of technical features, sonographic findings, results and comments.

**Results:** The size of the lesion was reported in 98%, the localization in 99% of the reports. Mentioning rates of the shape, orientation, acoustic feature, vascularity, elasticity properties were below 50% (resp.22%,15%,10%,20%). While the BIRADS classification were reported in the 58% of the reports, comments and suggestions were reported in 52% of them.

**Conclusion:** Arrangement of assessment and reporting standardization according to ACR-BIRADS criteria will contribute to better communication with clinicians as well as making decisions in the patient management process.

## Introduction

Today, breast ultrasound scan, which is mainly used in the differentiation of cystic-solid lesions of the breast, has an important role in distinguishing between benign and malignant lesions [1]. It is used as a primary diagnostic tool in cases with dense breast structure (Type C-D) in mammographic examination during breast screening, in order to complete the examination and increase the diagnostic accuracy, and in cases under the age of 40 [2]. In addition, it is used for diagnostic purposes in the presence of a clinical abnormality or palpable lesion, and for screening purposes in young patients with a family history of breast cancer [1, 2]. It is advantageous compared to other examination methods because of its radiation-free, accessible, applicable, inexpensive and practical features [2]. But the most important disadvantage of it is dependency on the operator, device and technical factors. Until today, the reporting process has been carried out in ultrasonography depending on personal preferences. However, reporting plays a key role among radiologists and clinicians in making clinical decisions in the patient management process. Therefore, an easy-to-understand and explanatory report containing important criteria should be prepared for the clinical decision-making process. For this purpose, the BIRADS (Breast Imaging Reporting and Data System) was first developed by the American College of Radiology (ACR) in 1993 to convey short and regular definitions of findings in a standardized language that could be understood by radiologists in mammography evaluation with clinicians. BIRADS is a dynamic and continuously improvable system that keeps up with developing technological changes (1993-1995-1998-2003-2013) [3, 4]. Dictionaries for ultrasound in 2003 and MRI in 2006 were included in the BIRADS classification, which was first created for mammographic evaluation. In the latest edition, BI-RADS 5th edition (2013), six classifications of lesions have been developed: category 1: negative, category 2: benign finding(s), category 3: probably

benign finding—initial short-interval follow-up suggested, category 4: suspicious abnormality— biopsy should be considered, category 5: highly suggestive of malignancy—appropriate action should be taken, and category 6: known biopsy-proven malignancy—appropriate action should be taken. An incomplete category was also provided, category 0: need additional imaging evaluation and/or prior mammograms for comparison [4]. These subsections are designed to make the radiologists who make the assessment possible to convey their findings and suggestions to other colleagues in a clear and concise summary form, to make their own follow-ups systematically, and to standardize patient evaluation [4].

In Turkey, there is no study that evaluates standardization of the report preparation for breast ultrasound scans. In this study, it was aimed to evaluate the suitability of breast ultrasound reports prepared by different doctors and hospitals in different cities of Turkey in terms of content and technical features according to the current ACR-BIRADS criteria (5th Edition, 2013).

## Subjects And Methods

230 breast ultrasound scan reports prepared between 2015–2020 were included in this retrospective study. The health centers where ultrasound scans were imaged were evaluated in 4 categories as university hospital, training and research hospital, state hospital and private hospital. State and private universities were classified as university hospitals, health centers affiliated with Health Sciences University were included training and research hospital group and private imaging centers were included in the private hospitals group.

In order to prevent bias, 980 reports collected in different cities from each health center category, with a maximum of 5 reports from each doctor, prepared by at least 2 different doctors from same health center and a maximum of 10 reports from each health center were evaluated. Technical features and content were evaluated by a single observer according to the ACR-BIRADS 5th Version (2013) criteria [5].

In the general and technical features section, information about the examination (*examination name and date*), patient information (*patient name, age, clinical and examination findings*), findings of previous examinations (*ultrasound, mammography, magnetic resonance examination (MR)*), device information (*device name, probe used, technical features of Doppler sonography and elastography*) were evaluated.

In the report section, tissue composition and eco-structure of surface (*homogeneous fatty, homogeneous fibroglandular, and heterogeneous*) were evaluated in terms of shape in lesion description (*oval, round, and irregular*), orientation (*parallel and not parallel*), margin (*circumscribed and not circumscribed-indistinct, angular, microlobulated, and spiculated*), echopattern (*anechoic, hyperechoic, hypoechoic, isoechoic and heterogeneous*), internal features (*cystic, complex cystic and solid*), posterior features (*no posterior acoustic features, enhancement, shadowing, and combined pattern*). The presence of calcification was evaluated according to the location (*in a mass, outside of a mass, intraductal calcifications*). Associated features; The changes caused by the lesion in the adjacent breast tissue (*architectural distortion, edema, ductal changes, skin changes (thickening-retraction)*) were evaluated in terms of vascularity (*absent, internal vascularity, and vessels in rim*) and elasticity (*soft, intermediate, and*

hard). In the special cases category, *simple cyst, clustered microcysts, complicated cysts, mass in or on skin, lymph nodes (intramammary, axillary), foreign body (implants), vascular abnormalities (arteriovenous malformations and Mondor disease), postsurgical fluid collection, and fat necrosis*) were evaluated. The evaluation template specified in ultrasonography section of the ACR-BIRADS 5th Edition is shown in Table-1 [5]. BIRADS 1 (normal) and BIRADS 2 (benign findings: *simple cyst, calcified fibroadenomas, non-pathologic intramammary lymph node, lipoma, sebaceous cyst, clustered microcysts, galactoseles, duct ectasia*) were excluded.

The rates of mentioning each finding in the reports, specifying the BIRADS category, reporting results-comments and/or suggestions were evaluated. In addition, it was calculated how many of the important features (shape, orientation, margin, echo structure, posterior feature, internal structure, calcification feature, vascularity, elasticity) of the lesion in terms of malignancy were mentioned per lesion.

## Statistical analysis

Frequency and ratio values were used in the descriptive statistics of the data. Chi-square test was used to analyze qualitative independent data, and Fischer test was used when Chi-square test conditions were not suitable. SPSS 26.0 software was used in the analysis.

## Results

After eliminating the reports in the BIRADS 1 and 2 categories among the 980 reports reported between 2015 and 2020, a total of 230 reports were included in the study (BIRADS 0-3-4-5-6). 57 reports from the university hospital (n: 6) group, 55 from the education and research hospital (n: 6) group, 58 from the state hospital (n: 8) group, and 60 from the private hospital (n: 12) group were evaluated.

While the size of the lesion was reported in 98% of the reports, and the localization in 99%; the distance of the lesion to the areola in 43% of the reports, its shape in 22%, and its orientation in 15% were reported. The margin feature of the lesions was stated as 72%, echo structure as 78%, posterior feature as 10% and internal structure as 66%. Doppler sonography feature (vascularity) was mentioned in 20% and elastographic features in 3% of the reports. In the conclusion section, the BIRADS (BIRADS 0 (n:4), BIRADS 3 (n:77), BIRADS 4 (n:36), BIRADS 5 (n:13), BIRADS-6 (n:4)) classified reports were prepared in 58%, while comments and suggestions were stated in 52%.

No significant difference was found between the name of the study, the date of the procedure, and the patient's name in all groups. The average age was significantly higher in the training and research hospital group than in others ( $p < 0.05$ ). The rate of clinical knowledge was the same between the university hospital group and the training and research hospital group, but it was significantly higher than the state hospital group and the private hospital group ( $p < 0.05$ ). Comparison with previous examinations and mention of technical features in the university hospital and private hospital groups were found to be significantly higher than the training and research hospital and state hospital groups ( $p < 0.05$ ), but there was no significant difference between these two groups.

During the report preparation phase, the tissue composition specification rates were found to be significantly lower in the state hospital group compared to other hospitals ( $p < 0.05$ ), while there was no significant difference between the university hospital, private hospital and training and research hospital groups. Size, localization, shape, orientation, margin, echo, posterior acoustic feature, internal structure and calcification information of lesion did not differ between all groups ( $p > 0.05$ ). Distance to the areola was significantly higher in the university hospital and state hospital groups than the others ( $p < 0.05$ ). Indication of the rates of vascularity-elasticity between hospitals did not differ significantly ( $p > 0.05$ ).

The rate of indicating BIRADS classification did not differ significantly between the university hospital, state hospital and training and research hospital groups ( $p > 0.05$ ), but it was significantly lower in the state hospital group ( $p < 0.05$ ). In addition, the rate of indicating comments and suggestions in the state hospital group was significantly lower ( $p < 0.05$ ) than the private hospital, training and research hospital and university hospital groups. There was no significant difference between private hospital, training and research hospital and university hospital groups ( $p > 0.05$ ). The findings of the study are summarized in Table-2.

## Discussion

Statements from the Introduction and Results sections should not be repeated here. The final paragraph should highlight the main conclusions of the study. The Results and Discussion sections may be combined. Sonographic features are extremely important in correctly characterizing breast lesions in the distinction between malignant and benign. Descriptors of these sonographic features are listed and exemplified by the ACR-BIRADS classification. BIRADS classification of lesions that can be detected sonographically are changeable according to shape, orientation, margin, echo pattern, posterior acoustic features, internal structure, vascularity and elasticity. These features should be considered when evaluating a sonographic lesion. According to the BIRADS ultrasound scan evaluation, the most important features in distinguishing malignant and benign lesions are shape, margin and orientation that can only be evaluated with ultrasound [6]. Rahbar et al. stated in their study that the ultrasound features that most reliably characterize the lesions as benign are round or oval shape (94%), well-circumscribed margin (91%) and transverse/anteroposterior diameter higher than 1.4 [6]. However, the most important criteria for malignancy were reported as irregular shape (61%), microlobulation in the contour (67%) or spiculation (67%), and transverse/anteroposterior diameter less than 1.4 (40%) [6]. In our study, while the rate of mentioning the margin feature of the lesions was 72%, a significant deficiency was found in terms of shape (22%) and orientation (15%). Sonographically, it is known that the positive predictive value of hypoechoic lesions in terms of malignancy is 70% and showing posterior acoustic shadowing is around 50% [6, 7, 8]. In our study, it was observed that the rate of mentioning the echogenicity characteristics of the lesions was relatively high (78%), while the posterior acoustic feature was mentioned at very low levels, such as 10%.

Sonographic characterization of lesions is highly dependent on device and technical factors as well as on the operator. Breast ultrasound scans should be examined with a high-resolution screen and a high

frequency probe. To obtain high quality images, the gain settings, focus area selections, and field of view should be optimized [9, 10].

Doppler ultrasonography has become widespread in the evaluation of breast lesions, because it does not require additional devices, additional software, detailed training or experience, and is easily accessible and applicable [11]. Basically, based on the principle that malignant lesions are more hypervascular than benign lesions, it has been shown that combined evaluation with Doppler ultrasound scan in addition to B-mode examination is superior to B-mode alone in distinguishing between benign and malignant breast lesions [11–13].

Elasticity assessment is one of the property categories to be applied to sonographic analysis of masses and is included in the Ultrasonography section in BIRADS 5th Edition. Elastography, which is an important examination in distinguishing benign-malignant breast lesions based on the hardness-softness of the tissues, increases the diagnostic accuracy of gray scale ultrasound scan [14, 15]. It is a cost-effective and useful modality for cancer diagnosis that can reduce the biopsy rate of benign breast lesions [16, 17]. To minimize communication or commentation errors in elastography examination, annotation should be made on the color scale with expressions of soft, medium or hard [18]. Although there was no significant difference between hospitals in our study, it was observed that the rate of indicating Doppler sonography and elastography features in all health center groups including university hospitals and training and research hospitals was quite low. Because of the reason that although Doppler sonography, which does not require additional devices or procedures and is easy to apply, is frequently used to evaluate the vascularity of suspicious lesions during screening, the vascularity feature is not mentioned much during the report preparation stage. On the other hand, elastography is a relatively new method compared to Doppler sonography. Not every device has elastography feature. In addition, since it is a method that requires training and experience, it has not been used routinely in every health center yet. For this reason, it has been reported significantly less than Doppler.

In report preparation stage, findings of the ultrasound scan should be correlated with other imaging findings such as clinical, physical examination and mammography/MRI. If the breast ultrasonography examination is performed to evaluate the clinical findings and/or symptoms and the findings in mammography, MRI or other screening methods, the findings of previous examinations must be stated in the report. In breast ultrasonography report, a detected lesion should be defined by stating the longest diameter with accompanying findings, and a dominant lesion in the presence of multiple lesions (the most suspicious lesion for malignancy, the largest lesion if all are benign in character). To facilitate subsequent follow-up or possible interventional procedures and to interfere with the correct lesion, the localization of the lesion should be stated according to the clock dial and with the distance from the nipple. In our study, the size feature was reported at a very high rate, such as 98%, while the distance to the areola was remarkably low at 43%. Again, the findings described in the reports should be correlated with clinical and mammography/other screening findings, if any. As a result, possible diagnoses and recommendations should be showed by interpreting the findings. The report preparation process should

be standardized in terms of healthy and universal communication with clinicians and other radiologists [18].

In our study, while describing the characteristics of the lesion in the report did not differ a significant change in all hospital groups; the rate of stating BIRADS classification and reporting results-comments-suggestions remained around 50% in general and were found to be significantly lower in the state hospital group. As a reason for this situation, we think that in hospitals with a high patient density, radiologists do not have enough time to examine or report in detail, and only indicate the findings of the lesion.

There are a limited number of studies that critically evaluate the content of ultrasound scans reported by radiologists [19]. In our literature research, we could not find a similar study that systematically evaluated breast ultrasound reports in terms of technical features, content and results. This retrospective multi-center study, in which we aim to reveal the deficiencies in report preparation stage, will set a first example for future studies in this respect.

The present study also has a number of limitations. First of all, due to the low sample amount in our study, we think that more objective results can be obtained with higher number of series. The fact that we could not achieve the histopathological results of the cases included in our study can be considered among the limitations of the study. In our study, categorical evaluation was not investigated according to city differences. In the future, there may be studies that reveal the differences in preparing international reports according to cities and even countries. Likewise, only the sonographic report preparation was the subject of our study, and in the future, differences in reporting on mammography and breast MRI reports in different studies and compliance with ACR-BIRADS criteria can be evaluated.

As a result, reporting the breast ultrasound scan, which has an important place in the diagnosis of breast cancer, make radiologists possible to communicate correctly with clinicians and patients. These reports play a key role in avoiding unnecessary follow-ups, investigations, attempts and concerns. Incomplete ultrasound scan reports negatively affect patient management process and clinical decisions. Therefore, ultrasonography evaluations and report preparations should be made and presented in a standardized manner within the framework of the ACR-BIRADS.

## **Declarations**

### **Funding Sources**

The authors declared that this study has received no financial support.

### **Conflict of Interest Statement**

The authors have no conflict of interest to declare.

### **Ethics approval**

No ethical approval was obtained because this study did not involve a prospective evaluation, did not involve laboratory animals. Patients were not required to give their informed consent for inclusion in this retrospective study, because we used anonymous clinical data and individual cannot be identified according to the data present.

### **Informed consent**

Written informed consent was not necessary because no patient data has been included in the manuscript

### **Availability of data and materials**

The materials described in the manuscript will be freely available to any scientist wishing to use them for non-commercial purposes, without breaching participant confidentiality.

### **Acknowledgement**

N/A

### **Author Contributions**

Concept – D.E.T.S, F.A.; Design - D.E.T.S, F.A.; Supervision – F.A.; Resource - D.E.T.S, F.A.; Materials - D.E.T.S, F.A.; Data Collection and/or Processing - D.E.T.S, F.A.; Analysis and/or Interpretation - D.E.T.S, F.A.; Literature Search - D.E.T.S, F.A.; Writing – D.E.T.S; Critical Reviews - D.E.T.S, F.A.

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## Tables

Table-1

## ACR-BIRADS ultrasonography evaluation criteria

Tissue composition (screening only)	a. Homogeneous background echotexture – fat	
	b. Homogeneous background echotexture – fibro glandular	
	c. Heterogeneous background echotexture	
Masses	Shape	Oval
		Round
		Irregular
	Orientation	Parallel
		Not parallel
	Margin	Circumscribed
		Not circumscribed
		- Indistinct
		- Angular
		- Micro lobulated
	Echo pattern	- Spiculated
		Anechoic
		Hyperechoic
		Complex cystic and solid
		Hypoechoic
		Isoechoic
Posterior features	Heterogeneous	
	No posterior features	
	Enhancement	
	Shadowing	
Calcifications	Combined pattern	
	Calcifications in a mass	
	Calcifications outside of a mass	
	Intraductal calcifications	
Associated	Architectural distortion	

features	Duct changes	
	Skin changes	Skin thickening
		Skin retraction
	Edema	
	Vascularity	Absent
		Internal vascularity
		Internal vascularity
	Elasticity assessment	Soft
		Intermediate
		Hard
Special cases	Simple cyst	
	Clustered microcysts	
	Complicated cyst	
	Mass in or on skin	
	Foreign body including implants	
	Lymph nodes – intramammary	
	Lymph nodes – axillary	
	Vascular abnormalities	AVMs (arteriovenous malformations / pseudoaneurysms)
		Mondor disease
	Postsurgical fluid collection	
Fat necrosis		

Table-2

Rate of mentions of ACR BIRADS ultrasonography evaluation criteria according to hospitals

	Total		State Hospital		Training and Education Hospital		University Hospital		Private Hospital		P	
	n	%	n	%	n	%	n	%	n	%		
Age	182	79	30	51,7	53	96,4	48	84,2	51	85,0	0,000	X <sup>2</sup>
Protocol	221	96	58	100	54	98,2	57	100	52	86,7	0,000	X <sup>2</sup>
Review Name	230	100	58	100	55	100	57	100	60	100	1,000	X <sup>2</sup>
Transaction date	230	100	58	100	55	100	57	100	60	100	1,000	X <sup>2</sup>
Clinical Information	46	20	9	15,5	13	23,6	19	33,3	5	8,3	0,006	X <sup>2</sup>
Other Findings	29	13	2	3,4	7	12,7	15	26,3	5	8,3	0,002	X <sup>2</sup>
Comparison	21	9	2	3,4	3	5,5	10	17,5	6	10,0	0,045	X <sup>2</sup>
Technical	25	11	0	0,0	3	5,5	12	21,1	10	16,7	0,001	X <sup>2</sup>
Tissue Composition	157	68	26	44,8	42	76,4	40	70,2	49	81,7	0,000	X <sup>2</sup>
Size	226	98	58	100	51	92,7	57	100	60	100	p 005	X <sup>2</sup>
Localization	228	99	58	100	54	98,2	57	100	59	98,3	P > 0.05	X <sup>2</sup>
Distance to Areola	99	43	35	60,3	15	27,3	29	50,9	20	33,3	0,001	X <sup>2</sup>
Shape	52	23	10	17,2	12	21,8	13	22,8	17	28,3	0,552	X <sup>2</sup>
Orientation	34	15	9	15,5	4	7,3	9	15,8	12	20,0	0,280	X <sup>2</sup>
Margin	166	72	43	74,1	40	72,7	42	73,7	41	68,3	0,891	X <sup>2</sup>
Margin	180	78	49	84,5	38	69,1	47	82,5	46	76,7	0,194	X <sup>2</sup>
Posterior Feature	22	10	4	6,9	3	5,5	7	12,3	8	13,3	0,388	X <sup>2</sup>
Internal Structure	152	66	40	69,0	35	63,6	39	68,4	38	63,3	0,872	X <sup>2</sup>

	Total		State Hospital		Training and Education Hospital		University Hospital		Private Hospital		P	
	n	%	n	%	n	%	n	%	n	%		
Calcification	30	13	4	6,9	8	14,5	11	19,3	7	11,7	0,250	x <sup>2</sup>
Associated Features	70	30	18	31,0	16	29,1	20	35,1	16	26,7	0,791	x <sup>2</sup>
Exceptions	91	40	20	34,5	18	32,7	17	29,8	36	60,0	0,002	x <sup>2</sup>
Birads	134	58	13	22,4	33	60,0	42	73,7	46	76,7	0,000	x <sup>2</sup>
Vascularity	47	20	7	12,1	8	14,5	17	29,8	15	25,0	0,057	x <sup>2</sup>
Elasticity	9	4	0	0,0	2	3,6	2	3,5	5	8,3	0,138	x <sup>2</sup>
Comment	119	52	19	32,8	28	50,9	32	56,1	40	66,7	0,003	x <sup>2</sup>
X <sup>2</sup> Chi-square test (Fisher's test)												