Effect of Anatomical and Physiological Factors on Ultrasonic Breast Imaging Reporting and Data System Score in Iraqi Women Presenting with Breast Lumps

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Abstract

BACKGROUND: Breast lumps are a common presentation that can be assess non-invasively using the ultrasonic examination.

AIM: The study aimed to assess the effect of different anatomical and physiological factors on the outcome of ultrasonic scoring of breast lumps.

METHODS: A total of 60 females presented with a breast lump on ultrasound assessment were randomly selected after their consent at the Clinic for Early Detection of Breast Cancer in Baghdad. The results were expressed according to the ultrasound breast imaging reporting and data system (BI-RADS) scoring.

RESULTS: There was a statistically significant positive correlation between the BI-RADS score with breast size, age, postmenopausal state, and personal or familial history of breast disease. Most cases (46.7%) scored BI-RADS II, followed by scores of III (21.6%), 4 (16.7%), and V (15%). The upper lateral quadrant of the breast was the most commonly affected sites. Marital status, parity, and breastfeeding didn't have statistically significant influence on the sores.

CONCLUSION: Ultrasonic BI-RADS scoring of breast lumps provides an initial reliable tool for the management of breast disease. Higher scores are associated with increasing breast size, age, postmenopausal state, and personal or familial history of breast disease. Several anatomical, physiological, hereditary, and environmental aspects influence such factors.

Introduction

Globally, breast cancer is the most known malignant disease in women over the age of 40 in the world, and the most stated cause of tumor death in ladies [1], [2]. It has been noticed that the fast recognition and early screening followed by suitable management declining the related morbidity and mortality degrees of the disease [3]. Earlier surveys from Iraq have stated that breast cancer is the most common recorded malignancy [4] and that most of the disease cases are often spotted among middle-aged ladies in moderately advanced stages [5], [6], [7]. Presenting with a breast lump is a common complaint in the female population. Although benign lesions form the majority of breast lumps, breast cancer remains a common hazard for women of different ages [8]. Radiological assessment of lumps offer a cost-effective non-invasive tool for diagnostic and therapeutic purposes [9].

Here, we assess the effects of anatomical and physiological factors on the results of the radiological assessment of breast lumps using ultrasound breast imaging reporting and data system (BI-RADS) scoring.

Methods

Study deign and setting

A total of 60 women were enrolled in the study, they were randomly selected after their consent at the Clinic for Early Detection of Breast Cancer at Al-Yarmouk Teaching Hospital, Baghdad and Al-Shahwany private ultrasound clinic in Baghdad during a 2 month period (November-December 2019).

Eligibility

Inclusion criteria was any female presenting with a breast lump for Ultrasound assessment. Exclusion criteria comprised a history of breast augmentation or signs and symptoms of breast inflammatory disorders.

Procedure

Anthropometric breast size measurement was adapted after Kayar *et al*. [10]. A specialized nurse used tape measure and simple ruler to take the measurements.

Each of the three radiuses (latera [LR], medial [MR], inferior [IR]) was measured from the center of the nipple to the skin fold of the breast with the chest wall in that direction. Mammary projection (MP) was measured using a simple ruler from the chest wall to the apex of the breast. All measurements were recorded in centimeters (cm) and the breast volume was calculated according to the equation:

$$\text{Breast size (cm}^3) = \pi/3 \times \text{MP2} \times (\text{MR+LR+IR-MP}) \text{ [10]}$$

Ultrasonography

Breast ultrasound was performed by a specialist using Voluson10© Ultrasound Machine (USA) with high-frequency rate linear probe at 8–12 MHz. Ultrasound results were expressed according to the ultrasound BI-RADS score, taking into consideration different mass criteria such as shape, orientation, margin, echo pattern, vascularity, calcification, and posterior features (Figure 1). Simply put, lower scores (≤3) indicate benign or normal findings. Scores of 4 or 5 have increased probability of malignancy meriting a biopsy [11].
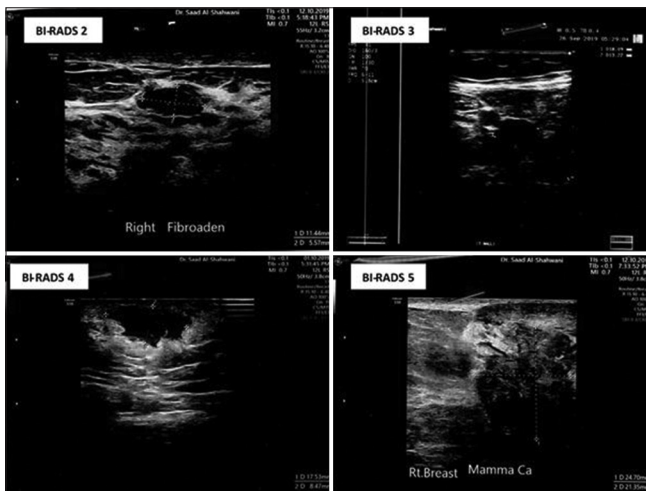

Figure 1: Different ultrasound breast imaging reporting and data system scores recorded in Iraqi women presenting with breast lumps

Data sources

A questionnaire was completed as shown below regarding the patient's age, marital status, menopausal status, parity, history of breastfeeding, breast disease (personal and familial), and affected breast quadrant.

Statistical analysis

Data were plotted and analyzed using Statistical Package for the Social Sciences version 24 and Microsoft office excel 2016. Statistical significance was calculated at a confidence interval of 95% with a $p < 0.05$ being of statistical significance. Numerical data were presented as means ± standard deviation (SD) for hypothesis testing (t-test) while categorical data were presented as frequency and percentage for Chi-square testing.

Case number / Name	
Age (Years)	
Age of menarche	
Menopausal status	☐ 1. Premenopausal ☐ 2. Postmenopausal
Quadrant of breast lump *(If lump involves more than 1 quadrant, consider the quadrant that has the greatest mass)*	☐ 1. Upper lateral ☐ 2. Lower lateral ☐ 3. Lower medial ☐ 4. Upper medial
Personal history of breast disease	☐ 1. Yes ☐ 2. No
Family history of breast disease	☐ 1. Yes ☐ 2. No
Marital status	☐ 1. Single ☐ 2. Married
Parity (Number of children)	
Breast feeding	☐ 1. Yes ☐ 2. No
Breast feeding duration (months)	
Lymph node enlargement	☐ 1. Yes ☐ 2. No ☐ 3. Unknown
Anatomic (anthropometric) breast measurement (cm) *(The measurements should be performed when the patient is sitting or standing with her arms at her sides) see images below*	Mammary projection (MP): Medial radius (MR): Lateral radius (LR): Inferior radius (IR):
Lump echogenicity (Ulrasound)	☐ 1. Solid ☐ 2. Fluid-filled
Lump follow-up diagnosis (if present)	☐ 1. Benign ☐ 2. Malignant ☐ 3. Unknown

Results

The mean age of females was 41.42 ± 12.5 years, ranged from 21 to 70 years. Table 1 summarizes the descriptive frequencies of the patients' data. Most cases (46.7%) scored BI-RADS II, followed by scores of III (21.6%), IV (16.7%), and V (15%), as shown in Figure 2. Breast size showed a positive correlation with the BI-RADS score, which one? ($r = 0.348$ at $p = 0.046$), i.e. the greater the breast size the greater the BI-RAD score was.

Table 1: Anatomical and physiological features of Iraqi women presenting with a breast lump

| Criteria	% (No.) No. 0 (count)
Menopausal status	
Premenopausal	76.7 (46)
Postmenopausal	23.3 (14)
Marital status	
Married	86.7 (52)
Single	13.3 (8)
Parity (in married women)	
Nulliparous	7.7 (4)
Uniparous	5.8 (3)
Multiparous	86.5 (45)
Personal history of breast disease	
Yes	25 (15)
No	75 (45)
Family history of breast disease	
Yes	50 (30)
No	50 (30)
Breast feeding history (for parous women)	
Yes	91.7%(44)
No	8.3 (4)
Affected breast quadrant	
Upper lateral	41.7 (25)
Lower lateral	35 (21)
Lower medial	11.7 (7)
Upper medial	11.7 (7)
Lymphadenopathy	
Yes	43.3 (26)
No	56.7 (34)
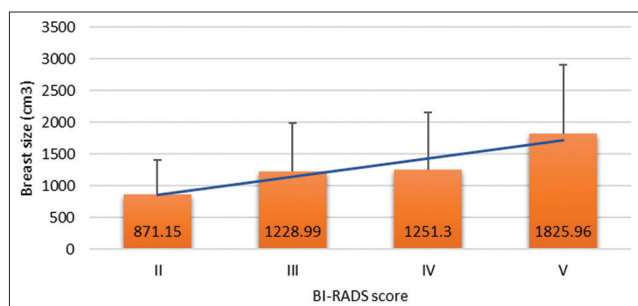
Figure 2: Effect of breast size on breast imaging reporting and data system score in Iraqi women with breast lumps (Numbers represent means, error bars = +SD, trend line = linear correlation)

Increasing age was also associated with increased BI-RADS scores (r = 0.649) with high statistical significance (p = 0.000) as shown in Figure 3.
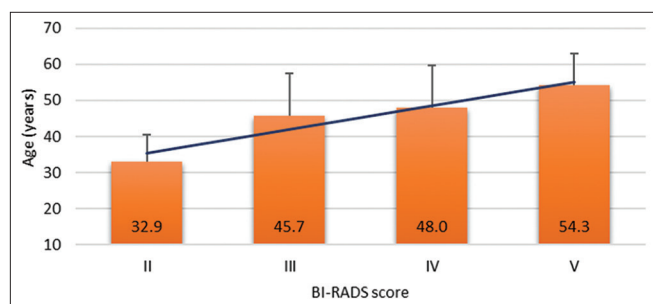

Figure 3: Effect of age on breast imaging reporting and data system score in Iraqi women with breast lumps (Numbers represent means, error bars = +SD, trend line = linear correlation)

Postmenopausal women had significantly higher BI-RADS scores (p = 0.004). Patients with personal or family history of breast disease had also higher scores (p = 0.001). Marital status, parity, breastfeeding history, and anatomical quadrant of the lump did not affect the BI-RADS score significantly. On the other hand, patients with lymphadenopathy had significantly higher scores (p = 0.033), as summarized in Table 2.

Discussion

The breast is a seen now as a complex organ, both anatomically and physiologically (i.e. several beast phenotypes are now recognized with variable parynchymal complexities) [12]. Mainly composed of a fatty tissue stroma in which the parenchymal mammary gland is embedded [13], the breast undergoes several episodic and periodic changes related to menarche, menstruation, pregnancy, lactation, menopause, and beyond [14]. All these changes, in addition to genetic and nutritional factors, affect the breast size and the probability of breast disease [15]. The current study showed a statistically significant positive correlation between the BI-RADS score (i.e. risk of malignancy) with breast size, age, postmenopausal state, and personal or familial history of breast disease. To the best of our

Table 2: Effects of anatomical and physiological factors on BI-RADS scores in Iraqi women presenting with a breast lump

Affecting criteria	BI-RADS score				p-value
	2	3	4	5	
	%				
Menopausal state					
Premenopausal	96.4	69.2	60	44.4	0.004
Postmenopausal	3.6	30.8	40	55.6	
Personal history of breast disease					
Yes	7.1	30.8	70	22.2	0.001
No	92.9	69.2	30	77.8	
Family history of breast disease					
Yes	42.9	53.8	80	55.5	0.013
No	57.1	46.2	20	44.4	
Marital status					
Married	78.6	100	80	100	0.147
Single	21.4	0	20	0	
Parity (in married women)					
Multiparous	81.8	84.6	100	88.9	0.384
Nulliparous	4.5	15.4	0	11.1	
Uniparous	13.6	0	0	0	
Breast feeding (in parous women)					
Yes	86.4	69.2	100	88.9	0.262
No	13.6	30.8	0	11.1	
Lymphadenopathy					
Yes	25	46.2	70	66.7	0.033
No	75	53.8	30	33.3	
Involved breast quadrant					
Upper lateral	50	46.2	30	22.2	0.414
Lower lateral	35.7	38.5	40	22.2	
Lower medial	10.7	7.7	10	22.2	
Upper medial	3.6	7.7	20	33.3	

BI-RADS: Breast imaging reporting and data system.

knowledge, no previous study used anthropometric breast size as a risk factor for the development of high BI-RADS scores or risk of breast malignancy. The effect of breast size on such risk may be related to several factors. Firstly, large breast size may be part of an overall state of overweight or obesity, yet, the this study does not include obesity in the study parameters, previous evidence shows the increased risk of malignant breast disease with it [16]. Secondly, larger breasts are more prone to mechanical trauma (Lu *et al*. suggested that Breast displacement of a female body during exercise might cause discomfort, breast pain, and even other injury to breast tissue) [17], especially in relation to wearing ill-fitted or unsuitable bras [18]. Finally, it may pose a certain degree of difficulty for patients to perform and/or detect breast lumps in larger breasts during self-examination, leading to a presentation of a higher BI-RADS score in larger breasts [19]. While the affected breast quadrant did not have an effect of the BI-RADS score outcome, the upper lateral quadrant of the breast remained the most affected region regardless of the score. This is consistent with other studies and may be related to the greater anatomical abundancy of parenchymal breast tissue in that quadrant [20], [21]. Age and postmenopausal state play a double role in increasing the BI-RADS score in the study. Several local and international studies may differ in the age group most susceptible to breast malignancy, but they almost invariably agree that the risk increases with increasing age [22]. This may be related to the longer exposure to dietary and other environmental factors that increase the risk [23]. The paramenopausal risk increase may be related to postmenopausal hormonal therapy use [24], premenopausal use of oral contraceptives [25], the timing of menarch/menopause [26] or a combination of all. Personal and familial history of breast cancer

increases the risk of high BI-RADS scores mainly by the inclusion of genetic risk factors and to lesser degree an increasing chance of gene mutation [27], [28]. Whereas many studies show a protective effect of marriage, parity and breastfeeding against breast cancer [29], the fact that the current study showed none may be related to discrepancies in these factors initiation and duration or simply a difference in sample size, ethnicity, and social standards [30].

Conclusion

Ultrasonic BI-RADS scoring of breast lumps provides an initial reliable tool for the management of breast disease. Higher scores are associated with increasing breast size, age, postmenopausal state and personal or familial history of breast disease. Several anatomical, physiological, hereditary, and environmental aspects influence such factors.

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