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Comparison of Mammography and Ultrasound Findings of Breast Masses based on BIRADS System with Pathological Findings

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ABSTRACT

Introduction: The situation of breast cancer patients has found a better perspective due to scientific and technological advances. The increasing use of imaging techniques such as mammography and ultrasound has been an important step in the early detection of breast cancer and has had significant effects on the biological increase of these patients. Breast cancer is diagnosed by combining findings from clinical examinations, imaging techniques and biopsy. The use of imaging along with thorough clinical examinations is recommended as an effective measure for better diagnosis of breast cancer. Therefore, the present study was performed to compare mammographic and ultrasound findings of breast masses based on BIRADS system with pathological findings.

Materials and Methods: This cross-sectional and retrospective study was performed on women suspected of having breast cancer referred to a hospital who subsequently underwent biopsy or surgical excision of the lesion. Surgical pathology reports were reviewed by a surgical pathologist according to the standard procedure and classified as "malignant" or "benign". In sonography, breast composition, findings related to mass, presence of calcification, associated features and cases with unique diagnosis or appearance of pathognomonic ultrasound were recorded. Mammography also recorded breast composition, mass findings, asymmetry, structural dislocation, calcification, and associated features. In order to analyze the data, SPSS software version 24 was used. Independent t-test, and chi-square were used to determine the significance. The P value 0.05 refers to the significance level.

Results: The mean age of patients was 40.59±13.03 years (11-82 years). And most patients were in the age group of 41-50 years (98 patients, 29.7%). It was also found that the prevalence of breast malignancy in women over 50 years was significantly higher than other age groups. The age of onset of breast cancer in other countries is over 50 years, while it is estimated to be over 40 years in Iran. 71 patients (21.5%) in the first degree relative had a family history of breast cancer, followed by 64 (19.4%) second degree relative. Additionally, 195 individuals (59.1%) did not have a family history of breast cancer. Also, family history of breast cancer had no significant effect on pathological findings (i.e., benign and malignant).

Conclusion: The most important reason for patients to refer to mass mammography in most patients was 4a breast masses based on BIRADS that had a diagnosis of fibroadenoma. Due to the importance of mammography and ultrasound, it is recommended that the quality and standard of these two diagnostic methods be standardized and improved, and the surgeon's clinical judgment based on history and correct clinical examination with these diagnostic methods should be the basis for breast diagnosis and treatment.

KEYWORDS

Breast Mass, Mammography, Ultrasound, BIRADS, Pathology.

Introduction

Breast cancer, an epithelial malignancy with the ability to attack regionally and remotely, is one of the leading causes of malignancy and the second most common cause of death in women worldwide. Reasons for the increase in breast cancer include the hormonal factors estrogen-progesterone, menopause, and the age of first pregnancy (1-3). One in eight women has a 12.5% lifetime risk of breast cancer (4). According to the ICMR, the incidence of breast cancer is one in 22 people, and the risk doubles in the second 24 years of life, and the risk increases by 3% each year, and most patients (about 80%) are advanced (5). Common pathologies of female breasts are mostly benign masses such as fibro adenoma, cyst, fibrocystic disease, abscess, galactocell, ectasia or enlarged lymph nodes, and sometimes cause malignancy (6). As long as the breast mass is less than 1 cm, it cannot be detected by examination. (2) The standard method of breast imaging is mammography and ultrasound, but sometimes other methods such as breast MRI, CEUS, breast biopsy are used (3). Diagnostic mammography is very accurate in the initial diagnosis and follow-up of bursal masses and its advantages are reproducible, safe, simple, acceptable and its main limitation is the inability to diagnose solid and cystic lesions. Also in young bursae due to fibro glandular tissue. Dense masses may be vague, so the sensitivity of mammography is reduced to 30 to 48%. Another disadvantage of False Negative Rate mammography is about 10%, which makes a negative mammogram cannot eliminate malignancy (7, 8). The next technique is the evaluation of ultrasound bursa, which is used especially in young bursa and dense, especially in the diagnosis of benign breast lesions such as lipomatosis and fatty cysts, which are not detectable in Real time mammography. Other benefits include

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the ability to use during pregnancy, the ability to stagnate malignancy, implant examination, and use as a guide to penetration. Ultrasound reduces the number of unnecessary biopsies by 20-25% (by identifying a simple cyst only). Using several methods simultaneously to evaluate masses increases the true positive rate. In a study conducted in India, the sensitivity of mammography alone is 86-91% and in combination with sonography is 19-19% (6). In a similar study conducted at King Khalid Hospital in Saudi Arabia, the results were as follows: The mean age of the patients was 42 years. Final pathology 28.6% malignant and 24.8% benign mammographic sensitivity 76.6% and ultrasound sensitivity 60%, BIRADS 1, 21% and BIRADS 2,11%. Also based on the location of the affected mass: 24.8% retroviral, 45.7% high and outside, etc. The final conclusion of this study was that the best tool for screening for malignant masses in people over 40 years of age is mammography (with high sensitivity) which is the most proximity to the pathology has pathological consequences, and in young people with denser breasts, the use of ultrasound is more reasonable (4). In another study conducted in Ghana, the mean age of people with palpable mass was 55 years, with Pathology of 50.5% for malignant lesions, 50.5% for physical examination, 73% for mammography, and 100% for ultrasound. It was concluded that physical examinations, mammography and sonography have good sensitivity and specificity in predicting dorsal malignancies (1) Considering the importance and prevalence of breast cancer in women and the effect of our ability to detect it early through examination, mammography and ultrasound in promoting health and disease management and increasing patient survival, we decided to use mammography and ultrasound findings of breast masses to compare the basis of the BIRADS system with the pathological findings.

Method and Materials

The present study is a retrospective cross-sectional study. The study population included all women with suspected breast cancer referred to Imam Reza (AS) Hospital in Birjand who then underwent biopsy or lesion surgery and a report of breast pathology related to surgery as well as imaging information including mammography and findings. They had ultrasounds by sample classification (BIRADS). The sample size was calculated using G power software at 0.05 alpha level, 95% test power and effect size about 0.3 times on at least 117 people. In this study, 330 female patients suspected of having breast cancer. Then they were screened for biopsy or surgical removal of the lesion, with a report of breast pathology, as well as imaging information, including mammographic findings. And ultrasound (BIRADS classification) are included in this study. Patients with a history of cancer of the same breast were involved in patients with incomplete information. Data were collected using a checklist prepared from patients' records. This check Includes all patient information including age, family history, location of the mass and findings observed in mammography and ultrasound and biopsy findings are the final result of the patient's pathology. Surgical pathology reports are reviewed by a surgical pathologist according to the standard method and classified as "malignant" or "benign".

In situ ductal carcinoma (DCIS), invasive ductal carcinoma (IDC), invasive lobular carcinoma (ILC), sarcoma, abnormal hyperplasia, metastatic tumor, and in situ polymorphic lobular carcinoma (LCIS) are in the "malignant" group. Other cases were considered benign. In ultrasound, breast composition, mass findings (shape, margin, orientation, echo pattern, features of the dorsal shadow), calcification, related features (structural dislocation, duct change, skin changes, edema, vascular bed) and cases Pathognomonic ultrasound was recorded with a unique diagnosis or appearance. Density), asymmetry, structural turbulence, calcification and related features (shrinkage of the skin or nipple, skin thickness> 2 mm, trabecular thickness, axial adenopathy) were recorded. Imaging and histological findings were considered "consistent" to provide acceptable histological findings for the imaging features, otherwise "incompatible". Classification of BIRADS from 0 to 6. BIRADS zero means that the radiologist cannot comment on the condition of the breast with this imaging finding and requires additional imaging. BIRADS means natural imaging. There are two findings in BIRADS that we know are of benign origin. Unlike BIRADS 2, in BIRADS we have three findings that are most likely to be benign, meaning the malignancy is below 2%. BIRADS has four or three subgroups and is defined as suspicious. 4a means that the probability of malignancy is between 2 and 10%. 4b means 10 to 50 percent chance of malignancy and 4c means 50 to 95 percent chance of malignancy. BIRADS 5 means the suspicion of malignancy with a probability of more than 95%.

Breast imaging studies are assigned one of seven assessment categories:

- BI-RADS 0: incomplete
  - Need additional imaging evaluation (additional mammographic views or ultrasound) and/or
  - For mammography, obtaining previous images not available at the time of reading
- BI-RADS 1: negative
  - Symmetrical and no masses, architectural distortion, or suspicious calcifications

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- BI-RADS 2: benign
  - 0% probability of malignancy
- BI-RADS 3: probably benign
  - <2% probability of malignancy
  - Short interval follow-up suggested
- BI-RADS 4: suspicious for malignancy
  - 2-94% probability of malignancy
  - For mammography and ultrasound, these can be further divided:
    - BI-RADS 4A: low suspicion for malignancy (2-9%)
    - BI-RADS 4B: moderate suspicion for malignancy (10-49%)
    - BI-RADS 4C: high suspicion for malignancy (50-94%)
  - Biopsy should be considered
- BI-RADS 5: highly suggestive of malignancy
  - >95% probability of malignancy
  - Appropriate action should be taken
- BI-RADS 6: known biopsy-proven malignancy

Results

In this study, 330 patients were studied with a mean age of 40.59±13.03 years (11-82 years). And most patients were in the age group of 41-50 years (98 patients, 29.7%). Furthermore, 71 patients (21.5%) in the first degree relative had a family history of breast cancer, followed by 64 (19.4%) second degree relative. Also, 195 people (59.1%) did not have a family history of breast cancer. The most important reason for mammography was touching the mass in Brest (86.1%). Fibroadenoma was also diagnosed in most patients (60.9%), and BIRADS 4a breast **lesions** were reported in most patients (40.6%), (Table 1). Pathological findings were diagnosed as benign for 246 patients (74.5%) and malignant for 84 patients (25.5%).

Table 1. Frequency distribution of patients based on ultrasound, mammography, pathology diagnosis and BIRADS findings

variable	Ultrasonic findings	frequency	percentage
Ultrasound findings	Microcalcification	3	0.9
	Debris	22	6.7
	Mass with indeterminate and infiltrative limits	81	24.6
	Branching hypoechoic areas	19	5.7
	Mass inside the duct	2	0.6
	Cysts with concentrated intradermal contents	1	0.3
	Mass with definite borders and lobules	201	60.9
	Mass with indefinite limits	1	0.3
Mammographic findings	Microcalcification	3	0.9
	Spiculated mass	81	24.6
	Distortion	20	6
	Mass with definite borders and lobules	201	60.9
	No answer	25	7.6
Type of pathology diagnosis	purulent infection	22	6.7
	Granulomatous mastitis	19	5.7
	Intraductal papilloma	2	0.6
	fat necrosis	1	0.3
	Epidemal cyst	1	0.3
	Fibroadenoma	201	60.9
	Invasive ductal carcinoma	58	17.6
	Ductal carcinoma in situ	3	9/0
	Invasive lobular carcinoma	22	6.7
	Atypical hyperplasia	1	0.3
BIRADS	2	1	0.3
	3	91	27.6

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	4a	134	40.6
	4b	12	3.6
	4c	30	9.1
	5	62	18.8

As shown in Table 2, most patients showed pathology of fibroadenoma (benign), of which 91 (45%) were BIRADS 3 and 110 (55%) were BIRADS 4a. In malignant patients, the highest frequency was related to invasive ductal carcinoma, of which 12 patients (21%) had BIRADS 4c and 46 patients (79%) had BIRADS 5.

Table 2. Frequency distribution of pathology diagnosis and BIRADS imaging findings in the studied patients by benign and malignant patients

BIRADS		**2**	**3**	**a4**	**b4**	**c4**	**5**	**Total number**
Pathology Findings		**Number (percentage)**						
Benign	Purulent infection	0	0	22 (100)	0	0	0	22 (100)
	Fibroadenoma	0	91 (45)	110 (55)	0	0	0	201 (100)
	Granulomatous mastitis	0	0	0	9 (47)	10(53)	0	19 (100)
	fat necrosis	0	0	0	1 (100)	0	0	1 (100)
	Epidermal cysts	1 (100)	0	0	0	0	0	1 (100)
	Intraductal papilloma			2 (100)	0	0	0	2 (100)
Malignant	Invasive ductal carcinoma	0	0	0	0	12(21)	46 (79)	58 (100)
	Ductal carcinoma in situ	0	0	0	2 (66.7)	1(33.3)	0	3 (100)
	Invasive lobular carcinoma	0	0	0	0	6(27.3)	16(72.7)	22 (100)
	Atypical hyperplasia	0	0	0	0	1 (100)	0	1 (100)

According to the results of Table 3, the prevalence of Brest malignancy in women over 50 years was significantly higher than other age groups. Furthermore, family history of breast cancer had no significant effect on pathological findings (i.e., benign and malignant). In addition, 2 (100%) of the patients who referred for checkup had malignancy, while 84 patients (29.6%) had malignancy by touching the mass in the breast at arrival. Other malignancies were not reported in other complaints and these differences were statistically significant.

Table 3. Frequency distribution of age groups, family history and type of patients' complaints based on pathology findings (benign and malignant))

Pathology diagnosis Variable		**benign**		**malignant**		**p**
		Number	**Percent**	**Number**	**Percentage**	
age categories	30 years and less	74	96.1	3	3.9	<0.001
	40-31 years	72	78.3	20	21.7	
	50-41 years	71	72.4	27	27.6	
	More than 50 years	27	42.9	36	57.1	
Family history	Negative	135	70.7	56	29.3	0.50
	Have	100	74.1	35	25.9	
Type of complaint	checkup	0	0	2	100	<0.001
	Fever and tenderness at the touch of the breast	22	100	0	0	
	Touch the lump in the breast	200	70.4	84	29.6	
	Feeling of pain and tightness in the breast	19	100	0	0	
	Blood and fluid secretion from the breast	2	100	0	0	
	Pain and swelling of the skin in the breast	1	100	0	0	

Results of the kappa coefficient table for agreement between the BIRADS system and pathological findings equal to 0.907, which indicates a high agreement in finding malignant and benign results in both methods. In this table, we considered the BIRADS 2 imaging findings as benign findings and the BIRADS 4c and 5 findings as malignant findings. This agreement was statistically significant. (P <0.001) (Table 4) According to the results of Table 4 showed that 24.8% of cases of malignant pathology in the imaging findings were also malignant (positive positive). 71.5% of cases with benign pathology were also benign in imaging findings (real negative). 3 ٪ by benign pathology and Lee by imaging findings Malignant (false positive) were diagnosed, all of which were

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granulomatous mastitis, and 0.6% were diagnosed by malignant pathology but with benign imaging findings (false negative). There is ductal carcinoma.

Table 4. Compatibility of pathology findings with imaging findings based on BIRADS system

		Pathology		Kappa	P
		Malignant	Benign		
Radiological finding based on BIRADS	Malignant	82(24.8%)	10(3.0%)	0.907	<0.001
	Benign	2(0.6%)	236(71.5%)		

Discussion

Due to scientific and technological advances, the condition of breast cancer patients has improved. However, these patients also have secondary problems due to the nature of the disease or various treatments for breast cancer (9). The increasing use of imaging techniques such as mammography and ultrasound has been an important step in the early detection of breast cancer and has had significant effects on the biological enhancement of these patients. Breast cancer is diagnosed by combining clinical findings, Examinations, imaging and sampling techniques. Restricting these stages, especially in young women, can lead to the non-diagnosis of cancerous lesions because none of these processes are flawless and alone cannot detect different types of cancer. Imaging, along with a thorough clinical examination, is recommended as an effective measure to better diagnose breast cancer. Therefore, the present study was performed to compare mammographic and sonographic findings of breast masses based on BIRADS system with pathological findings.

The results showed that the mean age of patients was 40.59 13.03.03 years (11-82 years) and most patients were in the age group of 41-50 years (98 patients, 29.7%). It was also found that the prevalence of breast cancer in women over 50 years is significantly higher than other age groups. The age of onset of breast cancer in other countries is more than 50 years, while in Iran it is estimated to be more than 40 years (10, 11). Rapid evaluation of breast problems in women is important to prevent delays in the diagnosis of breast cancer. With age, the incidence of breast cancer as a major cause of breast masses increases. 10 percent.

Breast masses are malignant in women aged 20 to 45 years, while this rate is 5% in the age group of 55 to 35 years, and 85% of breast masses in women over 55 years are due to cancer (12). Family history 71 (21.5%) in first degree family, 64 (19.4%) in second degree family and 195 (59.1%) had no family history of breast cancer. Also, the family history of breast cancer had a significant effect. Dari had no pathological findings (benign or malignant). In a satellite study, there was a significant relationship between a previous history of breast disease and a family history of breast cancer with mammography. 10.28% had a family history of malignant breast disorders and 15.94% had other breast related diseases (13). In the study of Routledge et al., The diagnostic mammography response was related to a family history of breast cancer and a history of breast disease (14). The lack of relevance observed in the present study may be due to the fact that they did not report their family history and also the lack of information about the disease status. It is in other family members that less family history is reported in patients. In this study, the BIRADS scoring system was used to report mammographic findings. According to the results of the study, fibro adenoma was diagnosed in most patients (60.9%) and most patients (40.6%) reported 4a breast masses based on BIRADS. In a study conducted in Iran, it was found that the most common benign masses and changes in breast tissue are fibro adenomas and cysts (15). The results of many studies have also shown that fibro adenoma is the most common benign mass among women (16, 17). According to the results of ALBERT et al., Out of 79 patients with benign lesions, 32 had fibrocystic, 19 had fibro adenoma, 9 had fibro sclerosis, 6 had papilloma, 3 had mastitis and 5 had adenosis sclerosis. Patients had intraductal carcinoma, 13 had invasive duct cancer, 3 had medullary and 1 had tubular cancer (18). In the study of Ranjkesh et al., 10 real masses were reported, of which 3 were invasive duct carcinomas. Of the remaining 7 cases, one was papilloma, 2 were fibroadenoma and 4 were benign fibrocystic changes (19). In a well-known study, et al. Had 20 true masses, of which 2 were simple cysts, 4 were fibrocystic changes, 6 were fibroadenomas, 1 was abscesses, 1 was lobular carcinoma, and 6 were intraductal cancer (20). In a study by Albert et al. Of the 100 breast lesions seen on mammography that match the biopsy results, of the 48 mammograms read benign, all 48 (100%) were benign on biopsy and 19 (61%) of the 31 malignancies were malignant. Were malignant in the sampling of 21 suspected malignancies on mammography, 19 were benign and only 2 were malignant (18). In a study by Pushpakant et al., 53 patients with chest symptoms referred for diagnostic mammography. There are 10 specific cases of biopsy-confirmed breast cancer. Mammography detected 8 lesions and did not detect two cancerous lesions (2 lesions on ultrasound were described as

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malignant). One in eight patients diagnosed with suspected lesions on mammography was benign on ultrasound. Also, four cases of breast cancer that could not be detected on ultrasound were detected by mammography (6). Elezaby et al., Who used the BIRADS group in diagnostic mammography, found that most patients had BIRADS 2 (46.3%). And 13.9% were in group 3 (21). According to the results of the study by Lorenzen et al., 632 diagnostic mammograms were performed. Mammography and sonography were performed for all patients and biopsies were performed for 554 patients. At the final diagnosis, 230 patients (36%) were benign and 402 patients (64%) were malignant. 11 patients (2%) BIRADS 1/2 and 142 patients (22%) 3 BIRADS and 264 patients (42%) BIRADS 4 and 215 patients had 5 BIRADS. The sensitivity and specificity of mammography were 92% and 75%, respectively. Due to the fact that the detection rate of mammography is clearly higher than that of ultrasound (22). A review of the literature has shown that mammography is a well-defined diagnostic method for breast lesions. However, they are not 100% sensitive and specific (23, 24). If mammography is performed in conjunction with ultrasound, it will be more sensitive and specific for detecting breast lesions. The results of the present study showed that most of the patients with benign pathology had fibroadenoma, of which 45% were BIRADS3 and 55% were BIRADS a4. In malignant patients, the highest incidence is associated with invasive duct carcinoma, with 21% BIRADS c4 and 79% BIRADS 5. According to the results of the present study, Sirus et al. In a study that examined the frequency distribution of breast imaging reports (BIRADS) and its changes in mammography, showed that there is a significant relationship between breast density and BIRADS classification and shows a higher risk of breast cancer in women with higher breast tissue density. (25) Breast tissue density is one of the most important factors in increasing the risk of breast cancer. In fact, women with high-density breast tissue are approximately 5 times more likely to develop breast cancer than women with low-density breast tissue (26-28) According to the results of the present study, the observed correlation between pathology results and imaging findings was very high. 3% were false positives and 0.6% were false negatives. In Mokht sources False positives of mammography are mentioned 10% and false negatives 17%. In the study of Kim et al., The simultaneous use of mammography and ultrasound reduced the number of false negatives to 0.06% (29). Another study in 2005 by a group of women at Hospital 3 and colleagues in Hussinger Erlingen, Germany, measured the mass size of 503 breast cancer patients by mammography, ultrasound, and physical examination. Mammography showed the best relationship with size. It is a pathological disease, although it increases the estimated tumor size compared to ultrasound and physical examination (30). Breast cancer is diagnosed by combining clinical examination findings, imaging techniques and biopsy. Limiting these stages, especially in young women, can lead to the non-diagnosis of cancerous lesions because none of these processes are flawless and alone cannot detect different types of cancer, so the use of imaging in addition to examinations, sample Accurate clinical and pathological examination is recommended. One of the limitations of the present study is that this study was conducted in one center. Other patients referred to other medical centers were not considered. Also lack of follow-up of patients whose findings Other limitations of the present study were positive pathology. A study with a larger sample size is recommended. This study was also performed in a hospital center and is recommended for larger scale and multicenter studies.

Conclusion

In general, the results of the study showed that the most important reason for patients to refer to mass mammography in most patients was 4a breast masses based on BIRADS that had a diagnosis of fibroadenoma. Due to the importance of mammography and ultrasound, it is recommended that the quality and standard of these two diagnostic methods be standardized and improved, and the surgeon's clinical judgment based on history and correct clinical examination with these diagnostic methods should be the basis for breast diagnosis and treatment.

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