Comparative study of breast core needle biopsy (CNB) findings with ultrasound BI-RADS subtyping

ABSTRACT:
Introduction: Given the high prevalence of breast cancer, developing quick and accessible diagnostics solutions is critical. The BI-RADS classification is a reliable method for assessing and estimating the risk of malignancy in breast lesions.

Aim: The aim of this study was to compare the results of core needle biopsy of breast lesions and sonographic findings based on the BI-RADS category in Yazd.

Materials and methods: This retrospective analytical study was done on all core needle biopsy specimens referred to Mortaz hospital, Yazd, Iran from 2010 to 2019. Demographic data such as age, laterality of the lesion, BI-RADS category, and pathology reports were extracted from patients’ hospital folders. Data were analyzed by SPSS version 21. P < 0.05 was considered statistically significant.

Results: In total, 514 cases with a mean age of 43.9 ± 9.4 years were studied. Among them, 104 cases (20.2%) were malignant and 410 cases (79.8%) were benign. The most common benign and malignant lesions were fibroadenoma (24.9%), and infiltrative ductal carcinoma (83.7%) respectively. The most common BI-RADS was class 4A (54.9%). Patients with benign lesions were mostly in the 3rd and 4th decade of life, while malignant lesions were more in the 4th and 5th decades, and this difference was statistically significant (P = 0.001). The correlation between ultrasound diagnoses (BI-RADS) and pathology findings was statistically significant (P < 0.001).

Conclusion: Based on the results, there is a significant correlation between ultrasound outcomes according to BI-RADS and pathology results, and the radiology-pathology accordance, owing to its high accuracy, can be very helpful in correctly diagnosing, monitoring, and managing the lesion.

KEYWORDS: BI-RADS, breast neoplasm, breast ultrasonography, needle biopsy

ABBREVIATIONS
BI-RADS – Breast Imaging-Reporting and Data System
CNB – core needle biopsy
FNA – fine needle aspiration
MRI – magnetic resonance imaging
ROC – receiver operating characteristic

INTRODUCTION
Breast cancer is the most prevalent cancer in women and the world’s second most common cancer [1]. This cancer has a significant death rate and is the second leading cause of malignancy in women aged 35–55 years after lung cancer [2, 3]. The overall incidence rate in Iran is projected to be 22.4 per 100 000 women, suggesting that the disease is increasing in this country [4]. This cancer is usually accompanied by a mammary tumor and breast pain. As a result, prompt diagnosis diagnosing, monitoring, and managing the lesion.

A substantial percentage of patients with breast pain/mass undergo ultrasound and mammography first; the use of this instrument is well proven, and its positive predictive value is close to 100% [8, 9]. Ultrasonography has been shown to be useful in distinguishing solid masses from cystic masses. Furthermore, ultrasonography has improved the capacity to distinguish between benign and malignant masses [10]. Following the first screening and after finding a lesion in the breast, lesion type and the degree of malignancy should be identified; one approach to this task is CNB, which may achieve 98% accuracy when conducted under the guidance of ultrasonography [11–15].

AIM
The aim of this study was to assess the outcomes of needle biopsy under the guidance of ultrasonography in individuals with a variety of breast pathologies.

MATERIALS AND METHODS
Patients
This descriptive-analytical cross-sectional study was performed in Mortaz hospital in Yazd province from 2010 to 2019. In total, 514 patients were evaluated whose CNBs and breast ultrasounds were carried out and the reports were based on the American Radiology
SPSS software version 21 was used to examine the data, which was then evaluated using appropriate statistical tests such as descriptive statistics (frequency and relative percentage) and appropriate tests (Chi-Square test). P less than 0.05 was considered statistically significant.

RESULTS

A total of 514 patients were eligible for the study. The patients’ mean age was 43.9 ± 9.4 years, with a range of 16 to 78 years. Of these, 104 cases (20.2%) were malignant and 410 cases were benign (79.8%). Fibrocystic changes (51.6%), fibroadenoma (19.8%), and infiltrative ductal carcinoma (16.9%) were the most prevalent pathological findings, respectively. Microcalcification was found in 128 patients (24.9%). The lesion in the left breast was found in 261 (50.8%) patients whereas the in the right breast in 253 (49.2%). The frequency distribution of ultrasound findings based on BARADS classification was as follows: BIRADS 4A (54.9%), (details are shown in Tab. I.).

Fibroadenoma (24.9%), ductal hyperplasia (24.1%), and mild fibrocystic changes (14.6%) were the most frequent benign lesions. The most frequent malignant lesion was infiltrative ductal carcinoma, with the incidence of 83.7%. According to Tab. II., the frequency distribution of benign lesions is not significantly associated with patients’ age (P = 0.18), and the majority of these lesions were in the 3rd and 4th decades of life. According to Tab. II., which depicts the distribution of benign lesions in terms of ultrasound findings, the majority of benign lesions in the 4A classification in the BIRADS system reflected mild suspicion of malignancy.

Ethical considerations

This study was approved by the Ethics Committee (IR.SSU.MEDICINE.REC.1400.144). Meanwhile, respecting the Helsinki Declaration, patients’ secrets were kept confidential and only used in accordance with the research aims, according to the retrospective study.

Statistical Analysis

SPSS software version 21 was used to examine the data, which was then evaluated using appropriate statistical tests such as descriptive statistics (frequency and relative percentage) and appropriate tests (Chi-Square test). P less than 0.05 was considered statistically significant.
**Tab. II.** Frequency distribution of benign lesions in terms of BIRADS, age group, and affected breast.

<table>
<thead>
<tr>
<th>LESION TYPE</th>
<th>BIRADS, N (%)</th>
<th>AGE GROUP, N (%)</th>
<th>BREAST SIDE, N (%)</th>
<th>TOTAL, N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4A</td>
</tr>
<tr>
<td>FIBROADENOMA</td>
<td>5</td>
<td>(4.9)</td>
<td>0</td>
<td>23 (22.5)</td>
</tr>
<tr>
<td>MILD DUCTAL EPITHELIAL HYPERPLASIA WITHOUT ATYPIA</td>
<td>5</td>
<td>(5.1)</td>
<td>1 (1.1)</td>
<td>25 (25.3)</td>
</tr>
<tr>
<td>MODERATE DUCTAL EPITHELIAL HYPERPLASIA WITHOUT ATYPIA</td>
<td>0</td>
<td>0</td>
<td>12 (20)</td>
<td>43 (71.7)</td>
</tr>
<tr>
<td>WITHOUT DUCTAL EPITHELIAL HYPERPLASIA WITH ATYPIA</td>
<td>5</td>
<td>(9.8)</td>
<td>0</td>
<td>12 (23.5)</td>
</tr>
<tr>
<td>FLORID DUCTAL EPITHELIAL HYPERPLASIA WITHOUT ATYPIA</td>
<td>4</td>
<td>(11.8)</td>
<td>0</td>
<td>2 (5.9)</td>
</tr>
<tr>
<td>GRANULOMATOUS MASTITIS</td>
<td>1</td>
<td>(4.5)</td>
<td>0</td>
<td>6 (27.3)</td>
</tr>
<tr>
<td>ATYPICAL DUCTAL EPITHELIAL HYPERPLASIA</td>
<td>2</td>
<td>(9.5)</td>
<td>0</td>
<td>1 (4.8)</td>
</tr>
<tr>
<td>DUCT ADENOSIS</td>
<td>1</td>
<td>(10)</td>
<td>0</td>
<td>2 (20)</td>
</tr>
<tr>
<td>OTHER</td>
<td>0</td>
<td>0</td>
<td>3 (27.3)</td>
<td>7 (63.6)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23</td>
<td>1</td>
<td>86</td>
<td>266</td>
</tr>
</tbody>
</table>

| P                                                 | 0.07 | 0.18 | 0.07 | - |

**Tab. III.** Frequency distribution of malignant lesions in terms of BIRADS, age group, and affected breast.

<table>
<thead>
<tr>
<th>LESION TYPE</th>
<th>BIRADS, N (%)</th>
<th>AGE GROUP, N (%)</th>
<th>BREAST SIDE, N (%)</th>
<th>MICROCALCIFICATION, N (%)</th>
<th>TOTAL, N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>3</td>
<td>4A</td>
<td>4B</td>
<td>4C</td>
</tr>
<tr>
<td>INVASIVE DUCTAL CARCINOMA</td>
<td>1 (1.1)</td>
<td>1 (1.1)</td>
<td>11 (12.6)</td>
<td>10 (11.5)</td>
<td>17 (19.5)</td>
</tr>
<tr>
<td>INVASIVE LOBULAR CARCINOMA</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5 (62.5)</td>
</tr>
<tr>
<td>DUCTAL CARCINOMA IN SITU</td>
<td>0</td>
<td>0</td>
<td>2 (66.7)</td>
<td>1 (33.3)</td>
<td>0</td>
</tr>
<tr>
<td>APOCRINE CARCINOMA</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>OTHER</td>
<td>0</td>
<td>0</td>
<td>3 (60)</td>
<td>0</td>
<td>2 (40)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1</td>
<td>1</td>
<td>16</td>
<td>11</td>
<td>24</td>
</tr>
</tbody>
</table>

| P                                                 | 0.19 | 0.5 | 0.33 | 0.38 | - |
The frequency distribution of malignant lesions in terms of breast side involvement was not statistically different (P = 0.33), according to Tab. III. Also, the distribution of malignant lesions in terms of microcalcification does not differ significantly (P = 0.38). The distribution of malignant lesions has no significant association with age (P = 0.5), and the majority of these lesions were in the 4th and 5th decades, according to Tab. III.

According to Tab. I., which depicts the distribution of malignant lesions based on ultrasound results, the majority of malignant lesions were categorized in the BIRADS system as 4C and 5, i.e. high suspicion for malignancy and highly suggestive of malignancy, respectively. The frequency distribution of malignant and benign lesions by age reveals that benign lesions are more common in the 3rd and 4th decades, while malignant lesions are more common in the 4th and 5th decades. Furthermore, the frequency of benign lesions in people over the age of 60 was 2.9%, whereas the frequency of malignant lesions was 11.5%, which is statistically significant (P = 0.001).

According to Tab. I., which illustrates the frequency distribution of benign and malignant lesions in terms of the side of involvement, 51.5% and 48.1% of benign and malignant lesions respectively were in the left breast, while the remainder were on the right side, therefore, based on P = 0.53 this correlation was not statistically significant. Microcalcifications were found in 18.3% of benign lesions, however, 51% of malignant lesions had a microcalcification. This difference was statistically significant (P = 0.001).

Based on Tab. I., the frequency distribution of benign and malignant lesions in terms of ultrasound findings shows that 64.9% of benign lesions were classified as mild suspicion for malignancy or 4A, while 45.2% and 23.1% of malignant lesions were classified as 5 and 4C, respectively. According to P = 0.001, the correlation between the classification of highly suspicious for malignancy and highly suggestive of malignancy, and the pathology reports was statistically significant.

**DISCUSSION**

Breast cancer, the most prevalent cancer in women, is the leading cause of cancer mortality in women aged 35–55, as well as the second most cause of death in women overall. This cancer accounts for 33% of all female cancers and for 19% of cancer-related deaths [7].

In Iran, breast cancer is more common in younger women (at least one decade younger than in developed countries), and unfortunately, many patients are diagnosed at advanced stages [16]. The carcinoma in situ was found in 15–30% of all cases, with invasive ones accounting for 70–85%. Based on the patient age, in asymptomatic women, specific screening tests such as annual mammography are performed. Diagnostic tests (such as MRI, blood tests, and bone scans or biopsy) might be used upon diagnosing the disease or suspecting it [7]. Several approaches, such as FNA and CNB, are used since the ultimate diagnostic approach involves direct sampling [17].

CNB has a higher sensitivity to FNA, and when used with radiological guidance, its sensitivity can range from 86 to 98%. CNB has a greater proportion of complications, which mostly include pain and bleeding. Moreover, the risk of bleeding is increased in women who use anticoagulant medications such as heparin or warfarin [18, 19].

Breast imaging involves ultrasound, mammography, and MRI, and each one has its own indications [19]. Although mammography and breast ultrasonography have adequate diagnostic accuracy in many cases in the assessment of benign and malignant lesions, breast cancer histopathology before choosing a therapy is essential and crucial [18]. The current study was a retrospective analytical study conducted at Mortaz Yazd hospital from 2017 to 2019 to identify and compare the findings of needle biopsy and ultrasound findings in breast lesions.

As compared to the results of needle biopsy and pathology, in 64.9% of cases, the ultrasound result in benign lesions according to BIRADS was 4A, while 45.2% and 23.1% of malignant lesions were suggestive of malignancy and highly suspicious for malignancy, respectively (BIRADS 5 and 4C). Given the fact that 21% of benign lesions in the pathology result were also benign in ultrasound, and ultrasound did not report any malignant lesion, indicates its proper accuracy in determining the type of lesion. In the study of Hong et al., of 403 samples, 141 cases (35%) were malignant. In their study, ultrasound manifestations associated with BIRADS, such as mass margin, shape, and echogenicity, were effective in distinguishing benign from malignant lesions, and there was a significant relationship between BIRADS classification and the benign or malignant origin of a breast mass, which was consistent with the current study [20].

According to the findings of this study, the majority of patients were in their 4th and 5th decades of life. Only 20.2% of the samples were malignant, and the number of lesions on the left and right side was nearly equal. Dr. Farrokh et al. investigated 139 individuals in a research, with a mean age of 42 years, and the left and right breast involvement was identical, as in our study [21].

Following a review of the BIRADS system, the classification has been split into three subgroups, i.e. 4A, 4B, and 4C, based on the probability of malignancy. In subgroup 4A, the probability of malignancy is 2–10%, in subgroup 4B, it is 11–15% and in the 4C subgroup 51–95%. In our study, in the benign group, there were 64.9% of cases of category 4A, while in the malignant group, there were cases of category 5 and 4C. According to Varella et al., the classification of BIRADS in the diagnosis of benign and malignant breast lesions has high accuracy in general (91%, the area under the ROC curve). However, the 4B classification has a positive predictive value of 25% and the 4A classification has a positive predictive value of 6% and is not specific to screening because it does not prevent biopsy. As a result, care of patients with lesions lower than 4 does not improve because all suspected lesions require biopsy [22]. Malignancy rates in the 4A, 4B, and 4C classifications were 5.6%, 31.4%, and 77.4%, respectively, in the current research.

The correlation between radiology and pathology, as well as the matching of pathological imaging results, is critical in determining the accuracy of BIRADS classification in distinguishing benign from malignant lesions. The decision to perform a re-biopsy or to follow up a patient for a short time depends on the radiology and cytology results [21].

Lesions with BIRADS 3 were found benign in histology, in a research done by Yousuf et al. Malignancy was found in 31% of BIRADS 4 lesions, and all BIRADS 5 cases were malignant in histology. According to the study, when breast lesions exhibit BIRADS 4B on ultrasonography and needle biopsy findings indicate benign...
lesions, supplementary histological diagnostic procedures are indicated to rule out cancer [23]. Similar to the current investigation, Yousefi et al. found that the most prevalent benign lesion was fibroadenoma and the most common malignant lesion was invasive ductal carcinoma [23].

In our study, only 1.1% of lesions with BIRADS 3 were malignant, and the remainder were benign, whereas in the study by Farrokh et al., malignancies were found in about 5% of BIRADS 3 lesions. This is most likely related to the low number of benign lesions seen in the Farrokh’s research. Heinig et al. published a research showing 1.2% of malignant lesions in the group with BIRADS 3. The prevalence of malignancy in the BIRADS 4 and 5 groups was found to be 17% and 94%, respectively [24]. The prevalence of malignancy in these three groups was 1.1%, 14.6%, and 94%, respectively, in this investigation. In Farrokh’s study, the prevalence of malignancy in BIRADS 4 ranged from 14 to 42% [21].

In a research by Ghaemian et al., 49.8% of the tumors were malignant, while the remainder were benign. The majority of benign lesions (70.1%) were classified as 4A, similar to the current study. The specificity of BIRADS 3 and BIRADS 5 in identifying benign and malignant lesions was 100%. BIRADS 5 also had a diagnosis accuracy of 80.3%. Their study suggest integrating ultrasound and mammography results for accurate diagnosis. Moreover, it was shown that the BIRADS classification had a high predictive value [25]. The findings of the Hawramy et al. study were similar to earlier studies in that BIRADS 5 and BIRADS 3 have the highest diagnosis accuracy in benign and malignant breast lesions [26].

Radhakrishna et al. reported 0.01% malignancy rate in 187 individuals with BIRADS 3, in their study of 467 patients with BIRADS 3 to 5. Furthermore, 30% of the 117 cases with BIRADS 4 were malignant [27]. The prevalence of malignancy in the BIRADS 4 group was 48% in the research by Hille et al. on a statistical population of 835 patients, which was lower than in other investigations. Furthermore, the prevalence of malignancy in BIRADS 5 was 97% [28]. In several studies, the rate of malignancy in the BIRADS 4 classification ranged between 15% and 67% in its subgroups. In the current study, most of the benign lesions were found in the 4A subgroup, while malignant lesions were found in the 4C subgroup. Furthermore, 24.9% of the samples in our study exhibited microcalcification that was substantially greater in malignant lesions. Due to a significant association between the malignant or benign lesion, microcalcification and patient age may improve the diagnostic accuracy. However, Lee et al. found that mammography and MRI did not improve the accuracy of diagnosis of lesions with microcalcification in individuals with BIRADS 3–5 [29].

The findings of this study revealed a significant relationship between the results of needle biopsy and ultrasound-based BIRADS classification, with most benign lesions falling into the 4A and lower classes, and most malignant lesions falling into the 4C and 5 classes. Paying attention to the patient age and the presence of microcalcification can also improve the diagnostic accuracy, because malignant lesions are more common in the 4 and 5 class and have microcalcification. According to the findings of this study, there is a good correlation between the results of BIRADS classification and ultrasound and the findings of needle biopsy, and because of the high accuracy of this method, the radiology-pathology match to determine patient follow-up and select suitable treatment. On the other hand, while mammography is the standard method of diagnosis of breast cancer, due to the recent increase in the incidence of breast cancer in the younger age groups and the presence of dense breast tissue at these ages, supplemental ultrasound, particularly in the younger age group, will be very effective in increasing the sensitivity of the diagnosis.

As a result of its use, the number of unnecessary samples may be decreased, as well as patient’s anxiety and high costs of diagnosis and treatment. On the other hand, with ultrasound assistance, the necessity for extra histological diagnostic measures is suggested and highlighted in instances when ultrasonography and pathology do not overlap.

CONCLUSION

As shown in the findings of this study, it appears that the high number of ultrasound tests performed in the early identification of benign and malignant breast lesions is suitable, however more extensive investigations are needed owing to the limited studies in Iran.


