Journal of Iranian Medical Council, Volume 7, Issue no. 3
http://dx.doi.org/10.18502/jimc.v7i3.15730

Original Article

Correlation of Ultrasound to Mammogram in Breast Lesions by BIRADS Category

Mohadeseh Zadehmir*, Amin Mashhadi and Behnaz Jahed

Department of Radiology, School of Medicine, Zahedan University of Medical Sciences, Zahedan, Iran

Abstract

Background: Breast cancer is the most common female cancer and the second leading cause of death worldwide. The gold standard tool for screening breast cancer, mammography has limitations in some instances, such as patients with dense breast tissue. This study evaluates the correlation of Ultrasound (US) to mammography in breast lesions in BI-RADS.

Methods: This prospective cross-sectional study was conducted at a tertiary hospital during 2019-2021. Women who referred to the radiology department for mammography with abnormalities appearing in their mammograms, with a minimum age of 40 and older, underwent ultrasonography. The results of mammography and US evaluations compared according to BI-RADS category. Statistical software SPSS was used to analyze the form data.

Results: In this study, 156 women with a mean age of 48/9 years registered. The US reports were equivalent to mammographic BI-RADS category 2 in 23 cases. All the 26 patients with mammographic BI-RADS category were categorized into BI-RADS 2 by US. Among 43 lesions with BI-RADS category 4 and 21 with BI-RADS category 5, 90/6% and 95/2% of sonography reports were similar to mammography findings. Based on the Pearson correlation coefficient of 0/68, there is a correlation between the results of US and mammography in this study.

Conclusion: This study reveals that US can be an excellent complement to mammography, particularly in identifying early-stage breast cancer in mammographic BI-RADS category 0 lesions. The mammographic-sonographic correlation should lead to more accurate diagnoses and better patient care.

Keywords: Breast, Mammography, Neoplasms, Ultrasonography

*** Corresponding author**

Mohadeseh Zadehmir, MD
Department of Radiology, School of Medicine, Zahedan University of Medical Sciences, Zahedan, Iran
Tel: +98 9151904038
Fax: +98 54 3329 5563
Email: mohadesezademir@gmail.com

Received: 3 Jul 2023
Accepted: 28 Oct 2023

Citation to this article
Zadehmir M, Mashhadi A, Jahed B. Correlation of Ultrasound to Mammogram in Breast Lesions by BIRADS Category. *J Iran Med Counc.* 2024;7(3):531-37.

Introduction

Breast cancer was the second leading cause of death among women in 2017, according to the International Agency for Cancer Statistics. The incidence of breast cancer has increased in all countries, especially in developing countries with an aging population (1). Iran's epidemiological model of breast cancer is similar to that of the East Mediterranean and developing countries (2). It is estimated that the onset of breast cancer in Iran is over 40 years, compared to 50 years in other countries (3,4). After an early breast cancer diagnosis in North America, the 5-year survival rate is over 80%. This illustrates the importance of an early and accurate breast cancer diagnosis (5).

In addition to mammography, sonography is crucial in increasing breast health (6), mainly since it does not expose women to ionizing radiation while undergoing mammograms (7,8). Mammography's overall sensitivity is 70–90%. The sensitivity of this test can vary from 80–98% in women with fatty breast tissue to 30–48% in those with dense breast tissue (9,10). Breast density is an independent risk factor for breast cancer, with estimates ranging from 2.8 to 6.0 (11,12). Mammographic sensitivity declines as breast density increases (11). In dense breasts, cancers may appear subtle or occult on mammography (13). Over one half of women younger than 50 and nearly one-third of women older than 50 have this type of tissue. Breast density is estimated to be associated with 28%–30% of breast cancers (12,14). There is a sixfold increase in the risk of interval cancer in women with dense breast tissue (10) and a deteriorating prognosis for subsequent cancers detected clinically. Women with dense breast tissue are four to six times more likely to develop cancer than women without dense breast tissue (11). Women with dense breasts are more likely to be detected early by MR imaging or Ultrasonography (US) following mammography (15). Due to its widespread availability, well-tolerated by patients, and similar cost to mammography, breast US is an attractive screening tool. Several studies have demonstrated an incremental cancer detection rate of 2.3–4.6 *per* 1000 women examined with supplemental breast US screening (9,16,17). Compared with screening mammography, breast US has low specificity and positive predictive values.

US has real-time capabilities, making sonography the preferred modality for guiding interventional procedures. Mammographic–sonographic correlation is necessary when sonography is used for further evaluation of mammographic findings. It is imperative to study this topic further due to the high spread of breast cancer and the low-age incidence in Iran. This study aimed to compare and evaluate US and mammographic findings in breast lesions by the BI-RADS category.

Materials and Methods

This prospective cohort study included 156 women who referred to the radiologic center of our tertiary referral hospital for mammography between 2019 and 2021. Women over 40 were enrolled in the study. Additionally, the study included patients with dense breasts and abnormal mammogram findings.

A Hologic full-field digital mammography unit (Hologic- Selenia Dimensions50002AS USA) used for craniocaudal and mediolateral oblique views. In addition, a 5-12 *MHZ* linear array transducer (Mindray DC7) was used for US. Mammographic images were reviewed by a general radiologist with seven years of experience. The results of this study reported using the BI-RADS category scoring system (18), and breast density classified using the ACR classification system. The patients were divided into four subgroups based on their breast density on mammography according to the American College of Radiology Breast Imaging Reporting and Data System (ACR BI-RADS) Atlas. There are four subcategories of breast density: A "(almost entirely fatty)", B "(scattered areas of fibroglandular density)", C "(heterogeneously dense breasts, which may obscure small masses)", and D "(extremely dense breasts, which lower mammography sensitivity)". BI-RADS classified mammographic findings into six groups. BI-RADS category 0 refers to cases that require further investigation with other imaging tools. Mammographic findings that do not indicate malignancy or benignity classified as BI-RADS category 1. BI-RADS category 2 includes benign masses such as hamartomas, intramammary lymph nodes, global asymmetry, and benign calcifications. BI-RADS category 3 refers to possible benign lesions such as well-circumscribed round or oval masses without calcification, malignant masses include

spiculated or irregular masses, linear and branching linear calcifications, and high-density masses. The following categories are also included in BI-RADS 4 and 5. Additionally, this group underwent sonography, and the findings were recorded and stored. The data and results were used only for research and kept confidential in a separate and secure location. A positive US finding consists of cystic and solid masses, as well as evidence of malignancy. BI-RADS categories are used again to avoid conflicting interpretations. Researchers reviewed the dimensions, sizes, and characteristics of recorded positive cases. As a final step, we compared BI-RADS categories for mammography and sonography findings.

SPSS software (version 23) was used to analyze the obtained information. Frequency distribution tables (absolute and relative) were used to describe quantitative and qualitative data based on central indices and distributions.

The study was approved by the local university's ethics committee. Participation in the study was possible with patients' permission. The study participants were allowed to leave the study at any time they wished. US was free.

Results

In this study, 156 women were included and underwent complementary sonography. The participants ranged in age from 40 to 72, and the average age was 48/9 (Figure 1). Based on the mammographic and sonographic findings, the patients were classified into 6 BI-RADS groups (Figures 2 and 3).

12 of the 23 mammography cases at BI-RADS 0 had breast composition C, and two had composition D (60%). Of the 26 items categorized in BI-RADS 3 in mammography, all were in BI-RADS category 2 in sonography. Out of 43 BI-RADS category 4 and 21 BI-RADS category 5 on mammography, 90.6% and 95.2% had similar findings in sonography (Table 1). The correlation coefficient between US and mammography in this study was 0.68, which indicates a significant correlation between these two diagnostic methods ($p<0.001$).

Discussion

Early detection and screening are beneficial in reducing breast cancer mortality and morbidity, the most common malignancy among women. Breast cancer screening is about detecting breast cancer early. The gold standard for breast cancer screening is mammography. Mammography, however, has diagnostic limitations in some cases, including dense breast tissue (common in women under 50).

According to our study, US and mammography were correlated. Of 23 cases in BI-RADS 0 mammography category, 4.3% (1/23) were BI-RADS category 4 US cases. Only one malignant mass was detected on mammography, but it turned out benign on US. Out of 43 cases classified in BI-RADS 2 mammography, all the sonographic findings were benign. In BI-RADS 3,

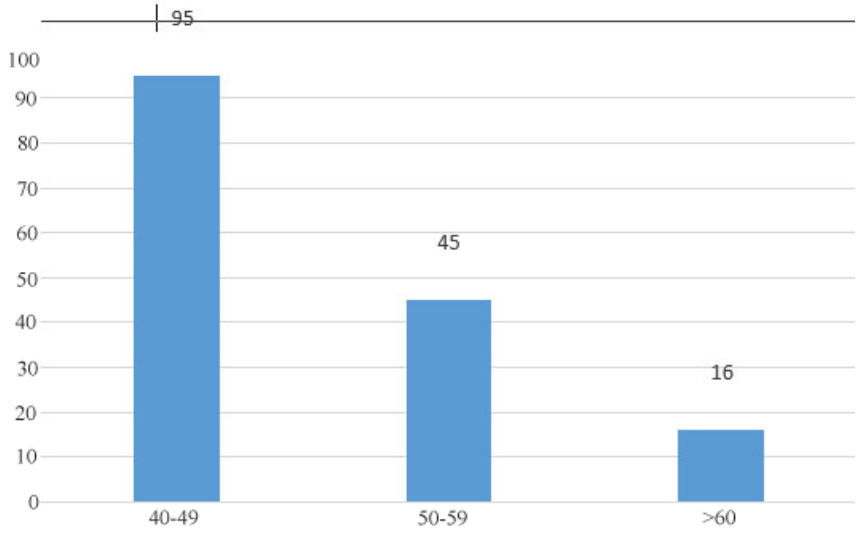

Figure 1. Frequency chart of different are groups.

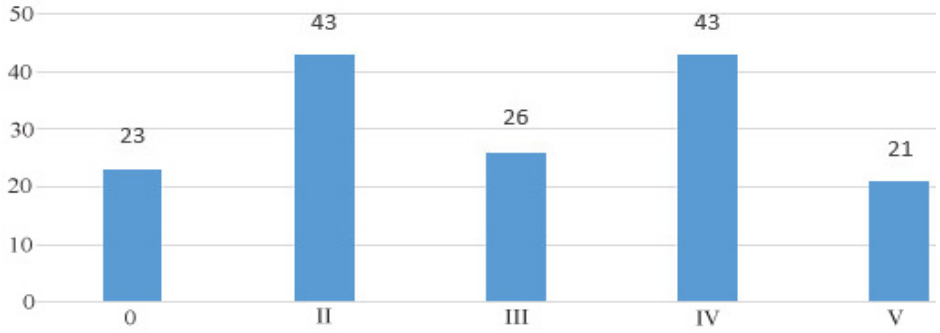

Figure 2. BIRADS mammography findings chart.

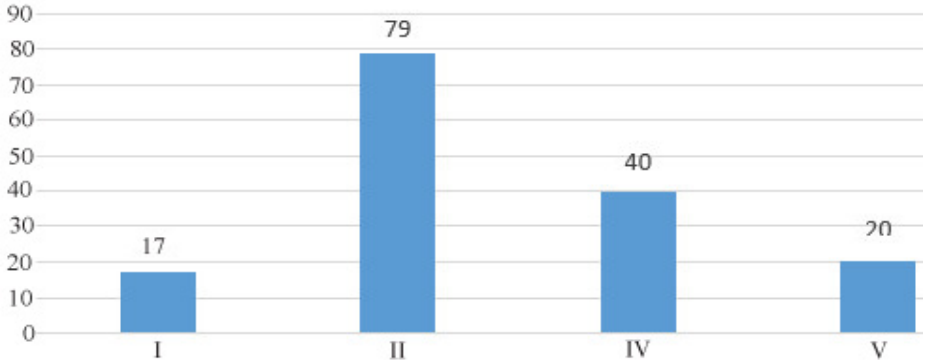

Figure 3. BIRADS sonography findings chart.

Table 1. Mammographic BIRADS *vs.* Ultrasound BIRADS

Variable/mammography BIRADS *vs.* ultrasound BIRADS	No.
Mammography BIRADS 0/Ultrasound BIRADS 1	1
Mammography BIRADS 0/Ultrasound BIRADS 2	21
Mammography BIRADS 0/Ultrasound BIRADS 4	1
Mammography BIRADS 0/Ultrasound BIRADS 5	0
Mammography BIRADS 2/Ultrasound BIRADS 1	11
Mammography BIRADS 2/Ultrasound BIRADS 2	32
Mammography BIRADS 2/Ultrasound BIRADS 4	0
Mammography BIRADS 2/Ultrasound BIRADS 5	0
Mammography BIRADS 3/Ultrasound BIRADS 1	0
Mammography BIRADS 3/Ultrasound BIRADS 2	26
Mammography BIRADS 3/Ultrasound BIRADS 4	0
Mammography BIRADS 3/Ultrasound BIRADS 5	0
Mammography BIRADS 4/Ultrasound BIRADS 1	4
Mammography BIRADS 4/Ultrasound BIRADS 2	0
Mammography BIRADS 4/Ultrasound BIRADS 4	39
Mammography BIRADS 4/Ultrasound BIRADS 5	0
Mammography BIRADS 5/Ultrasound BIRADS 1	1
Mammography BIRADS 5/Ultrasound BIRADS 2	0
Mammography BIRADS 5/Ultrasound BIRADS 4	0
Mammography BIRADS 5/Ultrasound BIRADS 5	20

4, and 5 100, 90.6, and 95.2% of BI-RADS categories were similar on mammogram and US, respectively. Complementary US showed different BI-RADS about 10 and 5%, respectively, according to mammographic BI-RADS 4 and 5.

Breast cancer US screening has gained acceptance, particularly in women with dense breasts and, or a high risk of developing the disease. Several studies have demonstrated that breast density is increased in more than half of women under 50 years of age (19), and in this study, 91.4% of dense breast cases were under 50. Complementary US has been recommended for people with dense breasts in BI-RADS 0 mammography in many studies. (13,20,21). Mammography could not be differentiated in these cases. Crystal *et al* revealed that dense breasts have more positive ultrasonography findings than other individuals. In instances where mammography could not detect malignancy, US detected 0.46%. BI-RADS 0 accounted for 7/14% of mammography cases in this study (22). Okello *et al* reported 14.9% of malignant masses in women with dense breasts (23), higher than this study.

According to Ranjkesh *et al*, neither benign mammography nor malignant sonography were

found in this study. According to the US results, 262 of 263 BI-RADS 1,2 mammograms were benign. On US, only one case of mammogram BI-RADS 1 was classified as BI-RADS 3 (24). In 65 lesions with BI-RADS category 0, 10 were diagnosed as malignant on sonography. A biopsy of 30% of the suspicious lesions revealed malignancy.

A study by Adibi *et al* revealed that BI-RADS category 1,2 on mammography shows similar results on US (20). BI-RADS 0 mammography patients with no new density were diagnosed with BI-RADS 1-2 after screening with US. US had no higher sensitivity than mammography for detecting breast cancer in patients with postmastectomy unilateral dense breast whether there was no new density. In comparison to mammography, sonography underestimated tumor size but had a better correlation with pathological tumor size. In the assessment of primary breast cancer, sonography is superior to mammography (25,26).

The study by Zanello *et al* found that 4.2% of the malignant masses were explicitly detected by US (27), which is comparable to this study. In Melnikow's study, 97% of the BI-RADS 5 mammography cases had similar BI-RADS in sonography (28), which is almost identical to this study (95.2%).

A combination of US and mammography detects 9% more breast cancers than either modality alone (29). In addition to reducing the possibility of missed diagnoses, the most accurate assessment will also decrease any criticism associated with them. By adding bilateral US to mammography, diagnostic sensitivity increases without increasing unnecessary biopsies in a specialized breast center.

Conclusion

According to this study, complementary US is helpful in diagnoses where mammography cannot distinguish (BI-RADS 0). The mammographic-sonographic correlation should lead to more accurate diagnoses and better patient care. As a result of increased diagnostic accuracy, breast cancer can be detected earlier, and the patient's uncertainty and anxiety can be reduced.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this study.

Acknowledgement

This study was conducted with the permission of the local university's ethics committee, with the research code: IR.ZAUMS.REC.1398.314

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. An J, Woo J, Lee J, Lee B. Tumor size measurements with breast MRI in elderly breast cancer patients: a comparison of breast mri with mammography and ultrasound. Iran J Radiol 2021;18(3)e110817.

2. Mousavi M, Montazeri A, Mohagheghi M, Mousavi A, Harirchi I, Najafi M, Ebrahimi M. Breast cancer in Iran: an epidemiological review. Breast J 2007November;13(4):383-391.

3. Mahtab Mohammadi Fard, Fatemeh Padidar, Mahyar Mohammadi Fard. Comparison of mammography and ultrasound findings of breast masses based on BI-RADS system with pathological findings. Ann Romanian Society Cell Biol 2946.

4. Harirchi I, Karbakhsh M, Kashefi A, Momtahen, AJ. Breast cancer in Iran: results of a multi-center study. Asian Pac J Cancer Prev 2004 Jan-Mar;5(1):24-7.

5. Yisheng S, Zhao Z, Yang Z, Xu F, Lu H, Zhu Z. Risk factors and prevention of breast cancer. Int J Biol Sci 2017 March;13(11):1387-97.

6. Luczynska E, Heinze S, Adamczvk AG, Rvs J, W Mitus J, Hendrick E. Comparison of the mammography,

contrast-enhanced spectral mammography and ultrasonography in a group of 116 patients. Anticancer Res 2016 Aug;36(8):4359-66.

7. Heywang SH, Lipsit LM Er, Glassman, Thomas MA. Specificity of ultrasonography in the diagnosis of benign breast masses. J Ultrasound Med 1984 Aug;3(10):453-461.

8. Han SH, Kang BJ, Baek JE, Lee HS, Kim SH. Glandular dose of full field digital mammography in Korean women based on specific factors. Iran J Radiol 2018;15(4)e62958.

9. Kolb TM, Lichy J, Newhouse JH. Comparison of the performance of screening mammography, physical examination, and breast US and evaluation of factors that influence them: an analysis of 27,825 patient evaluations. Radiology 225(1):165–75.

10. Mandelson MT, Oestreicher N, Porter PL, White D, Finder CA, Taplin SH, et al. Breast density as a predictor of mammographic detection: comparison of interval- and screen-detected cancers. J Natl Cancer Inst 2000 Jul 5;92(13):1081-7.

11. Harvey JA, Bovbjerg VE. Quantitative assessment of mammographic breast density: relationship with breast cancer risk. Radiology 2004 Jan;230(1):29-41.

12. Boyd NF, Byng JW, Jong RA, Fishell EK, Little LE, Miller AB, et al. Quantitative classification of mammographic densities and breast cancer risk: results from the Canadian National Breast Screening Study. J Natl Cancer Inst 1995 May 3;87(9):670-5.

13. Hooley RJ, Greenberg KL, Stackhouse RM, Geisel JL, Butler RS, Philpotts LE. Screening US in patients with mammographically dense breasts: initial experience with Connecticut Public Act 09-41. Radiology 2012 Oct;265(1):59-69.

14. Byrne C, Schairer C, Wolfe J, Parekh N, Salane M, Brinton LA, et al. Mammographic features and breast cancer risk: effects with time, age, and menopause status. J Natl Cancer Inst 1995 Nov 1;87(21):1622-9.

15. Parris T, Wakefield D, Frimmer H. Real world performance of screening breast ultrasound following enactment of Connecticut Bill 458. Breast J 2013 Jan;19(1):64-70.

16. Buchberger W, Niehoff A, Obrist P, DeKoekkoek-Doll P, Dünser M. Clinically and mammographically occult breast lesions: detection and classification with high-resolution sonography. Semin Ultrasound CT MR 2000 Aug;21(4):325-36.

17. Kaplan SS. Clinical utility of bilateral whole-breast US in the evaluation of women with dense breast tissue. Radiology 221(3):641–9.

18. D'Orsi CJ, Sickles EA, Mendelson EB, Morris EA, et al. ACR BI-RADS® Atlas, breast imaging reporting and data system. Reston, VA: American College of Radiology; 2013.

19. Kelemen LE, Pankratz VS, Sellers TA, Brandt KR, Wang A, Janney C, et al. Age-specific trends in mammographic density: the Minnesota Breast Cancer Family Study. Am J Epidemiol 2008;167(9):1027-36.

20. Adibi A, Golshahi M, Sirus M, Kazemi K. Breast cancer screening: evidence of the effect of adjunct ultrasound screening in women with unilateral mammography-negative dense breasts. J Res Med Sci 2015;20(3):228-32.

21. Masroor I, Ahmed MN, Pasha S. To evaluate the role of sonography as an adjunct to mammography in women with dense breasts. J Pak Med Assoc 2009 May;59(5):298-301.

22. Crystal P, Strano SD, Shcharynski S, Koretz MJ. Using sonography to screen women with mammographically dense breasts. AJR Am J Roentgenol 2003 Jul 1;181(1):177-82.

23. Okello J, Kisembo H, Buziga S, Galukande M. Breast cancer detection using sonography in women with mammographically dense breasts. BMC Med Imaging 2014 Dec 30:14:41.

24. Ranjkesh M, Fathi Azar F, Ghatreh Samani F, Tarzamni MK, Vali Khani E. Evaluation of adjunctive sonography results in screening of women with mammographically dense breasts for early diagnosis of breast cancer. Iran J

Breast Dis 2017 Jun 10;10(1):7-19.

25. Hieken TJ, Harrison J, Herreros J, Velasco JM. Correlating sonography, mammography, and pathology in the assessment of breast cancer size. Am J Surg 2001;182(4):351–4.

26. Wang JT, Chang LM, Song X, Zhao LX, Li JT, Zhang WG, et al. Comparison of primary breast cancer size by mammography and sonography. Asian Pac J Cancer Prev 2014;15(22):9759-61.

27. Zanello PA, Robim AF, Oliveira TM, Elias Junior J, Andrade JM, Monteiro CR, et al. Breast ultrasound diagnostic performance and outcomes for mass lesion using breast imaging reporting and data system category 0 mammogram. Clinics (Sao Paulo) 2011;66(3):443-8.

28. Melnikow J, Fenton JJ, Whitlock EP, Miglioretti DL, Weyrich MS, Thompson JH, et al. Supplemental screening for breast cancer in women with dense breasts: a systematic review for the U.S. preventive services task force. Ann Intern Med 2016 Feb 16;164(4):268-78.

29. Malik SS, Akhtar T, Malik S. Mammographic-sonographic correlation in the diagnosis of breast lump. Biomedica 2008 Jul;24(2):147-51.