Comparison of Ultrasound and Mammography With Pathologic Examination in Determining the Size of Malignant Breast Masses

Elham Shobeiri[1], Mohsen Fath Ordoubadi[1], Marzieh Jahanian[1], Nasrin Amiri[2]

[1] *Department of Radiology, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran*

[2] *Department of Radiation Oncology, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Received: 11 Dec. 2019; Accepted: 14 Mar. 2020

Abstract- Estimation of breast tumor size is one of the most important diagnostic measures in determining the appropriate treatment. Mammography and ultrasound are the main methods for determining the size of breast tumors. The aim of this study was to compare the correlation between tumor size calculated by breast ultrasound and mammography with the results of pathologic measurements in malignant breast masses. Patients diagnosed with breast cancer by pathologic examination underwent mammography and ultrasound to determine the size of the tumor. The largest observed diameter in ultrasound and mammography was recorded as the tumor size. The mean (SD) tumor size measured by ultrasound (23.58±9.38 mm) was significantly less than the actual size based on histopathologic examination (28.87±11.17 mm) (*P*=0.008). However, there was no significant difference between the measurements performed between mammography (26.54±10.46 mm) and histopathology (*P*=0.18). The correlation coefficient between mammography and pathologic examination (r=0.61) was higher than the correlation coefficient between ultrasonography and pathology (r=0.5). Mammography, compared to breast ultrasound, had better accuracy in determining the size of malignant breast masses.

Acta Med Iran 2020;58(4):166-170.

Keywords: Mammography; Ultrasound; Breast cancer

Introduction

Screening patients using mammography is the only imaging technique with a proven reduction in breast cancer-related mortality. Over the past few years, ultrasound has been introduced as an adjunctive tool for breast cancer screening, but there is controversy about the true value of ultrasound. Most researchers believe that ultrasound can be performed in cases where mammograms show abnormal results in favor of malignancy (1). Ultrasound significantly improves the diagnosis of breast cancer, especially in women with dense breast tissue (2).

In addition to screening objectives and detecting malignant breast masses, another important application of these non-invasive diagnostic methods is tumor size estimation. The actual size of malignant breast tumors, which is precisely determined by histopathologic examination, has been described in several studies as a variable in patient survival (3,4). Tumor size estimation is an important criterion in determining the type of treatment (5), with the increasing tendency of treatment and especially breast mucosal surgery to preserve mammary tissue.

Also, determining the exact size of the tumor and its expansion upon diagnosis has a significant effect on the choice of the type of surgery and associated therapies. The success of breast preservation depends on measuring the exact size of the tumor. Implicit measurement of the size of the tumor leads to imperfect margins and even re-removal. Therefore, tumor size is an important factor in determining neoadjuvant therapy and chemotherapy (6).

So far, several studies have examined the accuracy of mammography and ultrasound diagnosis in determining the size of malignant breast masses (7,8). In addition to these two methods, during the last few years, MRI has also been considered by the researchers as a way of examining and estimating the size of the breast tumor (9-11). However, in previous studies, there are conflicting results about the diagnostic accuracy of these three methods in estimating the size of breast masses. For example, although some studies have considered the

Corresponding Author: E. Shobeiri
Department of Radiology, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran
Tel: +98 8334276301, Fax: +98 8334276320, E-mail address: elhamshobeiri@gmail.com

precision of MRI more than ultrasound and mammography (11), others have reported that routine use of MRI can lead to a high or low prevalence of breast masses and can increase the amount of unnecessary mastectomy (12,13). Another study has shown that not only does MRI overestimate the size of the tumor, but the ultrasound can also underestimate the actual size (14).

Given that ultrasound and mammography are the most accessible and most useful methods for diagnosis in examining the size of tumors in breast cancer and the contradictory results reported in previous studies, it was decided in this study to determine the diagnostic accuracy of breast ultrasound and mammography with the actual size of the tumors based on the results of the pathologic examination.

Materials and Methods

In this cross-sectional study, the study population consisted of women with histologically confirmed breast cancer who were referred to our radiology department for mammography and breast ultrasound examinations. Exclusion criteria were neo-adjuvant chemotherapy, patients whose tumors were not visible or measured by ultrasound and/or mammography, and history of previous surgery in the breast.

In order to determine the size of the tumor in mammography and ultrasound, the largest diameter of the mass was considered. Patients whose tumors with ultrasound and mammography were no more than 0.5 centimeters different from pathologic examination were considered as an agreement between these two examinations.

The ultrasound instrument used was the General sonography machine (S6 model). The instrument used for mammograms was a digital plan mammography device. Pathology results were also determined based on FNA (fine needle aspiration) or CNB (core needle biopsy).

Statistical analysis

First, the Kolmogorov-Smirnov (KS) test was used to check the normal distribution of the data. A paired t-test was used to compare the mean size of malignant breast masses measured by ultrasound and mammography and compared with the pathological outcomes. Pearson's correlation coefficient was used to determine the correlation coefficient of malignant breast masses based on ultrasound or mammography with pathologic results. Z-test was used to determine the correlation between ultrasound and mammography with pathologic results in determining the size of malignant breast masses. The significance level was set at 0.05. SPSS (version 22) was used for data analysis.

Results

In this study, 31 patients with breast cancer were studied. The age range of the patients was between 19 and 56 years, with a mean (SD) value of 36.77 (10.72) years. Table 1 and Figure 1 shows measurements made using ultrasound, mammography, and histopathologic examination.

Table 2 shows the comparison of mean measurements performed on sonography, mammography, and pathology. As seen, the mean size of the tumor measured by ultrasound was significantly less than the actual size based on the histopathologic examination. However, there was no significant difference between the measurements performed between mammography and histopathology.

According to correlation analysis, both ultrasound and mammography had a statistically significant correlation with a histopathologic examination, however correlation coefficient by mammography method (r=0.61, $P<0.001$) was higher than that of ultrasound (r=0.503, $P=0.004$); (z test, $P=0.042$) (Figures 2 and 3).

Table 1. Descriptive indices of the tumor size based on breast ultrasound, mammography, and histopathologic examination

	Minimum	Maximum	Median	Mean	SD
Ultrasound	10	50	22	23.58	9.38
Mammography	7	57	25	26.54	10.46
Histopathology	10	50	30	28.87	11.17

Table 2. Comparison of mean tumor sizes measured by breast ultrasound, mammography, and histopathology

	Mean (±SD)	*P*
Ultrasound	23.58 (±9.38)	0.008
Mammography	26.54 (±10.46)	0.18
Histopathology	28.87 (±11.17)	--

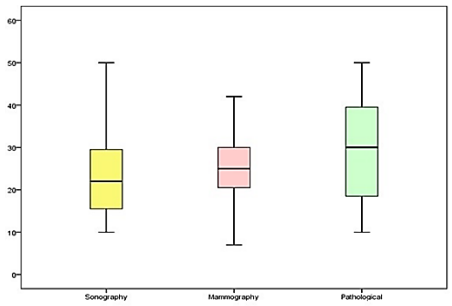

Figure 1. Tumor sizes measured by ultrasound, mammography, and histopathologic examinations

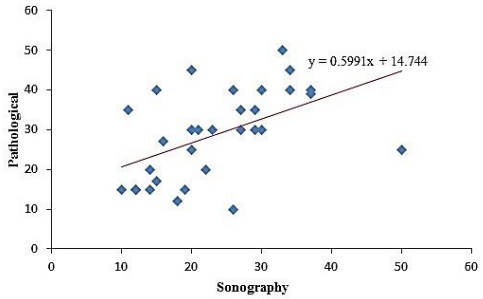

Figure 2. Correlation between breast tumor sizes measured by breast ultrasound and pathology

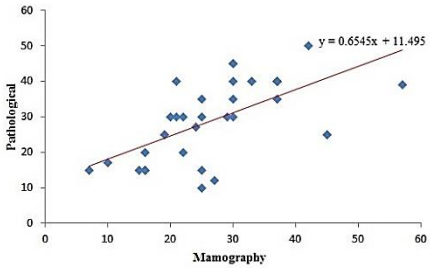

Figure 3. Correlation between breast tumor sizes measured by mammography and pathology

Discussion

Tumor size is an important pathologic variable in determining treatment and prognosis of breast cancer (15). Based on the results of this study, the mean size of malignant breast masses was lower than the pathologic results based on ultrasonography results. However, there was no significant difference between the size of malignant breast masses based on mammography and histopathological reports. There was a significant correlation between the size of malignant breast masses based on ultrasonography and pathological reports. There was a direct correlation between the size of malignant breast masses based on mammography and pathological outcomes. The correlation between mammography and pathological outcomes was higher than the correlation between sonography and pathological reports in determining the size of the masses. Therefore, it can be stated that mammography, in contrast to ultrasonography, had better accuracy in determining the size of malignant breast masses.

In a previous study (16), in agreement with the current results, the authors reported that ultrasound correlates with pathologic reports. Mammography also had a significant correlation with the pathological measurement, although it overestimates the tumor size, it was more useful than ultrasound. In another study (17), the authors concluded that a better correlation coefficient was found based on sonography and pathological findings (r=0.57) than mammography and pathological outcomes (r=0.26) in determining the size of breast tumors. Another study (18) found that the average size of the breast tumor

was less than that of the pathology by ultrasound and mammography. Of course, the difference was not meaningful. Also, sonography and mammography in determining the size of the breast tumor with pathologic outcomes had a correlation coefficient of 0.67 and 0.76, respectively.

In a study by Gruber *et al.*, (9), they showed that breast tumor size was significantly smaller with ultrasound, and the greatest difference between tumor size was based on ultrasonography and pathology in invasive lobular breast cancer. Of course, there was no difference between the size of the tumor on the basis of mammography and pathological measurement. Furthermore, there was a direct correlation between the size of breast tumors based on ultrasound and pathological outcomes (r=0.52). There was a direct correlation between the size of breast tumors based on mammography and pathological outcomes (r=0.55). In a study by Leddy *et al.*, (13), in agreement with the presented results, there was no significant difference in the size of breast tumors based on sonography and mammography with pathologic results. However, in contrast to our results, ultrasonographic measurements had a moderate agreement with pathological outcomes (r=0.71), but there was a poor agreement with pathologic findings, according to mammography (r=0.58). The measurements obtained by ultrasound and mammography are more accurate, and the measurements obtained by ultrasound are slightly more accurate than mammographic measurements. This discrepancy can be due to the difference in the biopsy method.

In the study of Cortadellas *et al.*, (19), in agreement with what we observed here, there was no significant difference between the size of malignant breast masses by ultrasound and mammography with pathological reports. However, in contrast, there was a significant correlation between breast tumor size based on sonography and pathologic results (r=0.68). There was a direct correlation between the size of breast tumors based on mammography and pathological outcomes (r=0.57). This discrepancy can be due to the difference in the sample size of the two studies.

Our study had some limitations. Because this was a cross-sectional study, a causal relationship cannot be determined. Due to the limited sample size, further investigations were not possible at different age groups.

There was a direct correlation between the size of malignant breast masses based on sonography and mammography with pathologic reports. However, mammography, in contrast to ultrasound, had better accuracy in determining the size of malignant breast masses. Therefore, radiologists, using more attention to mammograms in malignant breast masses, can help surgeons in avoiding possible complications and reducing the possible damage from surgery, according to the size of the malignant breast masses.

References

1. Katz B, Raker C, Edmonson D, Gass J, Stuckey A, Rizack T. Predicting Breast Tumor Size for Pre-operative Planning: Which Imaging Modality is Best? Breast J 2017;23:52-8.
2. Meuwly JY. [Ultrasound for Breast Cancer Screening: an Effective Tool in a Personalized Screening]. Praxis (Bern 1994) 2015;104:1399-404.
3. Yu KD, Jiang YZ, Chen S, Cao ZG, Wu J, Shen ZZ, et al. Effect of large tumor size on cancer-specific mortality in node-negative breast cancer. Mayo Clin Proc 2012;87:1171-80.
4. Narod SA. Tumour size predicts long-term survival among women with lymph node-positive breast cancer. Curr Oncol 2012;19:249-53.
5. Baek SH, Choi WJ, Cha JH, Kim HH, Shin HJ, Chae EY. Comparison of mammography, ultrasound, and MRI in size assessment of ductal carcinoma in situ with histopathologic correlation. Acta Radiol 2017;58:1434-41.
6. 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;15:9759-61.
7. Scoggins ME, Fox PS, Kuerer HM, Rauch GM, Benveniste AP, Park YM, et al. Correlation between sonographic findings and clinicopathologic and biologic features of pure ductal carcinoma in situ in 691 patients. AJR Am J Roentgenol 2015;204:878-88.
8. Eichler C, Abrar S, Puppe J, Arndt M, Ohlinger R, Hahn M, et al. Detection of Ductal Carcinoma In Situ by Ultrasound and Mammography: Size-dependent Inaccuracy. Anticancer Res 2017;37:5065-70.
9. Gruber IV, Rueckert M, Kagan KO, Staebler A, Siegmann KC, Hartkopf A, et al. Measurement of tumour size with mammography, sonography and magnetic resonance imaging as compared to histological tumour size in primary breast cancer. BMC Cancer 2013;13:328.
10. Daniel OK, Lim SM, Kim JH, Park HS, Park S, Kim SI. Preoperative prediction of the size of pure ductal carcinoma in situ using three imaging modalities as compared to histopathological size: does magnetic resonance imaging add value? Breast Cancer Res Treat 2017;164:437-44.
11. Luparia A, Mariscotti G, Durando M, Ciatto S, Bosco D,

Campanino PP, et al. Accuracy of tumour size assessment in the preoperative staging of breast cancer: comparison of digital mammography, tomosynthesis, ultrasound and MRI. Radiol Med 2013;118:1119-36.

12. Haraldsdottir KH, Jonsson T, Halldorsdottir AB, Tranberg KG, Asgeirsson KS. Tumor Size of Invasive Breast Cancer on Magnetic Resonance Imaging and Conventional Imaging (Mammogram/Ultrasound): Comparison with Pathological Size and Clinical Implications. Scand J Surg 2017;106:68-73.
13. Leddy R, Irshad A, Metcalfe A, Mabalam P, Abid A, Ackerman S, et al. Comparative accuracy of preoperative tumor size assessment on mammography, sonography, and MRI: Is the accuracy affected by breast density or cancer subtype? J Clin Ultrasound 2016;44:17-25.
14. Lai HW, Chen DR, Wu YC, Chen CJ, Lee CW, Kuo SJ, et al. Comparison of the Diagnostic Accuracy of Magnetic Resonance Imaging with Sonography in the Prediction of Breast Cancer Tumor Size: A Concordance Analysis with Histopathologically Determined Tumor Size. Ann Surg Oncol 2015;22:3816-23.
15. Ensani F, Hajsadeghi N, Amoozegar-Hashemi F, Haddad P. Evaluation of the effects of biological prognostic and predictive factors on survival of breast cancer patients, Acta Med Iran 2007;45:95-100.
16. Dummin LJ, Cox M, Plant L. Prediction of breast tumor size by mammography and sonography--A breast screen experience. Breast 2007;16:38-46.
17. Wasif N, Garreau J, Terando A, Kirsch D, Mund DF, Giuliano AE. MRI versus ultrasonography and mammography for preoperative assessment of breast cancer. Am Surg 2009;75:970-5.
18. Ramirez SI, Scholle M, Buckmaster J, Paley RH, Kowdley GC. Breast cancer tumor size assessment with mammography, ultrasonography, and magnetic resonance imaging at a community based multidisciplinary breast center. Am Surg 2012;78:440-6.
19. Cortadellas T, Argacha P, Acosta J, Rabasa J, Peiro R, Gomez M, et al. Estimation of tumor size in breast cancer comparing clinical examination, mammography, ultrasound and MRI-correlation with the pathological analysis of the surgical specimen. Gland Surg 2017;6:330-5.