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# Diagnostic Yield of High-Resolution Breast Sonography in Detecting Microcalcifications Compared to Mammography

**Background/Objective:** Mammography remains the most suitable screening test in detecting microcalcifications as the earliest manifestation of breast malignancy. By means of high-frequency transducers yielding high-resolution breast imaging, some researchers have reported that ultrasonography is capable of depicting microcalcifications in the breast tissue. Therefore, this study has been designed to compare the diagnostic yield of high-resolution breast ultrasonography (HRS) versus conventional mammography.

**Patients and Methods:** Seventy-four consecutive patients who had breast microcalcifications (hyperdense foci < 0.5mm) according to standard mammograms, without a prior history of breast disease, surgery, biopsy, chest wall radiation or systemic chemotherapy were enrolled. Considering mammograms as a reference, 46 patients without a mass, voluntarily underwent high-resolution bilateral breast ultrasonography.

**Results:** The mean age was 50.7±10 years (range, 35-85 years). The upper outer quadrant of the breast was the commonest place where microcalcifications were detected (36.9%). A relative frequency of 45.7% was reported for microcalcifications with breast imaging reporting and data system (BIRADS) score 3. An overall 82.6% diagnostic yield was discovered for HRS in detecting microcalcifications; it detected all microcalcifications with BIRADS score 4 and 5, but 57.1% and 90.5% of microcalcifications with BIRADS score 2 and 3, respectively. Cluster microcalcification was the most common pattern (43.5%).

**Conclusion:** Considering the 82.6% diagnostic yield of HRS compared to mammography, it can be proposed as the surrogate modality in locating microcalcifications in procedures such as biopsies and hook-wiring, with the advantage of reducing radiation exposure. HRS may be the future screening modality as a result of feasibility, safety, compliance and accuracy.

**Keywords:** Microcalcification, High Resolution Breast Sonography, BIRADS, Mammography

## Introduction

Apart from skin cancers, breast cancer with a one in eight lifetime risk of developing, is the most common malignancy in women.[1] Although among all imaging modalities, patients prefer ultrasonography (US), mammography remains the most suitable screening test due to the high sensitivity in detecting microcalcification as the earliest manifestation of breast malignancy.[2] Ultrasonography has been considered as a non-sensitive companion to other screening tests. By means of high-frequency transducers yielding high-resolution breast imaging, some researchers have reported that ultrasonography is capable of depicting microcalcifications in the breast tissue.[3,4] Just as US devices have advanced during the past decade, many studies have been carried out to determine the sensitivity of US in depicting microcalcifications and to evaluate this modality as a guiding technique in leading guide wires or performing percutaneous breast biopsies.[4-8]

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**Table 1.** BIRADS score

| Score | Definition |
|---|---|
| 0 | Need additional imaging evaluation |
| 1 | Negative |
| 2 | Benign finding |
| 3 | Probably benign finding, short interval follow-up suggested |
| 4 | Suspicious abnormality, biopsy should be considered |
| 5 | Highly suggestive of malignancy, appropriate action should be taken |

Meta analysis of the available data on the diagnostic yield of ultrasonography in detecting microcalcifications has not been possible, as a consequence of profound methodological difference due to the rapid pace of technology growth during the past decade. Although recent studies have yielded a sensitivity of 75%-90% for US in depicting mammographically detected microcalcifications,[4,6,7] many studies have considered US as a companion test to mammography based on the general consensus on incapability of US as a single screening test.

This study has been designed to compare the diagnostic yield of high-resolution breast ultrasonography (HRS) versus conventional mammography as the current gold standard modality in detecting breast microcalcifications. If it is proved that US could detect these microcalcifications, as a result, this modality could be used as the guiding tool for performing procedures such as biopsy and wiring.

## Patients and Methods

Seventy-four consecutive patients who were referred to our clinic in a one-year period from April 2005 and had breast microcalcifications (hyperdense foci smaller than 0.5mm) according to standard mammograms, without a prior history of breast disease, surgery or biopsy, chest wall radiation exposure or systemic chemotherapy were selected. Twenty-eight of these patients were excluded due to the presence of an adjacent mass or cyst to the microcalcification site in order to eliminate any possible guiding effect when seeking microcalcification by sonograghy. Forty-six patients with mammographic microcalcifications and no mass comprised the subject group and were enrolled in the study. These patients voluntarily underwent high-resolution bilateral breast ultrasonography according to their microcalcification on the mammogram as a reference. Therefore, the radiologists were not blind on the mammographies. We used Siemens linear array multi frequency 8-13 MHz probe of a Siemens Sonoline Antares to determine whether the high resolution sonography could detect determined microcalcifications in the breast tissue. Two expert sonologists who had reached common definitions and consensus about the US method and interpretation assessed all the patients.

Ethical issues were in concordance with declaration of Helsinki throughout the design and performance of the study. The diagnostic yield of high-resolution breast sonography was evaluated, moreover; in mammography, the location and the classification were evaluated according to the breast imaging reporting and data system (BIRADS)[9] (Table 1) and in sonography, the size of pathologic findings were eva-

**Table 2.** The Location of Microcalcifications in Mammography (Frequency and Percentage)

| Location | Frequency | Percent |
|---|---|---|
| Left areola region | 3 | 6.5 |
| Left lower inner quadrant | 4 | 8.7 |
| Left lower outer quadrant | 3 | 6.5 |
| Left upper inner quadrant | 3 | 6.5 |
| Left upper outer quadrant | 7 | 15.2 |
| Right areola region | 2 | 4.3 |
| Right lower inner quadrant | 2 | 4.3 |
| Right lower outer quadrant | 1 | 2.2 |
| Right upper inner quadrant | 2 | 4.3 |
| Right upper outer quadrant | 10 | 21.7 |
| Regional | 9 | 19.6 |

**Table 3.** The Frequency and Percentage of Microcalcifications in Mammography

| BIRADS Score | Frequency | Percent |
|---|---|---|
| 2 | 14 | 30.4 |
| 3 | 21 | 45.7 |
| 4 | 8 | 17.4 |
| 5 | 3 | 6.5 |

luated.

## Results

Among 46 patients with the mean age of 50.7±10 years (range: 35-85 years), the upper outer quadrant was the commonest place where microcalcifications were detected (36.9%) which was followed by the regional pattern (involvement of more than two nearby quadrants) (19.6%) and the lower inner quadrant (13%) (Table 2). A frequency of 45.7 % was reported for BIRADS score 3 microcalcifications (Table 3).

Moreover, the diagnostic yield of high-resolution breast sonography in detecting microcalcifications was 82.6% (8 patients were not detected) [95% Confidence Interval: 72%-94%]. Parallel to the increase in BIRADS scores, the diagnostic yield improved in finding microcalcifications and reached to its highest point (100%) in BIRADS scores 4 and 5 (Table 4). Cluster microcalcification was the most common pattern (43.5%) (Table 5).

## Discussion

It has been highlighted in textbooks that 40%-50% of malignancies are located in the upper outer quadrants. We found that the upper outer quadrant of the breast is the commonest place where microcalcifications are detected.

**Table 4.** The Diagnostic Yield of High Resolution Breast Sonography in Detecting Microcalcifications in Different BIRADS Scores

| BIRADS Score | Sonography | |
|---|---|---|
| | detected% | 95% CI* |
| 2 | 57.1 | 31-83 |
| 3 | 90.5 | 78-100 |
| 4 | 100 | 100-100 |
| 5 | 100 | 100-100 |

*CI: Confidence Interval

**Table 5.** Sonographic Visibility of Different Mammographically Detected Microcalcification patterns

| Mammographic Appearance | Frequency | Percent |
|---|---|---|
| Distribution | | |
| Regional | 9 | 19.6 |
| Cluster | 20 | 43.5 |
| Segmental | 5 | 10.9 |
| Linear | 4 | 8.7 |

Soo et al. noticed that cluster distribution pattern was the commonest pattern in sonography (73%),[6] the same result was detected by Cheung YC et al.[7] and we also found that this pattern is the commonest pattern, while the regional pattern had a higher frequency compared with other studies.

Currently, mammography is the method of choice for screening and it is the gold standard for identifying microcalcifications,[5] our objective was to investigate whether high resolution breast sonography is able to compete with it. Some authors uttered that high-frequency ultrasonography is an efficient non-invasive method for diagnosing and localizing breast microcalcifications, and it can be utilized as an alternative for guiding hook wire,[10] moreover, other researchers said that it is useful for guiding biopsy and microcalcifications in malignant lesions.[4-6,] This study showed an overall 82.6% diagnostic yield of high-resolution breast sonography in detecting microcalcifications, which may not seem very satisfying at first; however, table 3 illustrates that the diagnostic yield of high-resolution breast sonography is 100% for BI-RADS scores 4 and 5 and 90.5% for score 3. Its ability in finding score 2 pathologies was disappointing (57.1%). The fact that patients with BIRADS score 2 are advised for annual follow ups with mammography, and women with BIRADS score 3 are recommended to repeat their mammography after 6 months without biopsy, demonstrates that high-resolution breast sonography does not fail in detecting important pathologies.

We found that the diagnostic yield of US had been improved in higher BIRADS scores. It has been mentioned that the number of clusters have increased in higher BIRADS scores. This could explain the reason higher scores have greater diagnostic yields; when the cluster numbers are higher (BIRADS increases), the clusters would be easily seen on US and as a result, the probability of US detection would get higher.[11]

Although not proven yet, there is concern that maybe some differences may occur between the results of the general population and the volunteered patients who were enrolled in our study.

Considering the safety, comfort and better acceptance by patients, maybe it could be used as an accessory method or even substitute for mammo-guided

biopsies in the future. These are first steps of ultrasound roles in microcalcification detection which could be an introduction to define sonographic criteria for blind detection and classification of microcalcifications and determining their malignancy risk. Additionally, the role of this modality could be assessed for the follow-up of patients who underwent adjuvant therapy. Furthermore, it could be evaluated for more accurate staging of breast diseases and estimating pathological grades.

In conclusion, high-resolution breast sonography is capable of visualizing microcalcifications in patients without guiding pathology in their mammography. Its diagnostic yield is reasonable and increases when there is high suspicion of malignancy in the mammography.

## References


1. Reeder JG, Vogel VG. Breast cancer risk management. Clin Breast Cancer 2007 Dec;7(11):833-40.
2. Bassett LW. Mammographic analysis of calcifications. Radiol Clin North Am 1992;30:93-105.
3. Rickard MT. Ultrasound of malignant breast microcalcifications. Australas Radiol 1996;40(1):26–31.
4. Gufler H, Buitrago-Tellez CH, Madjar H, Allmann KH, Uhl M, Rohr-Reyes A. Ultrasound demonstration of mammographically detected microcalcifications. Acta Radiol 2000 May;41(3):217-21.
5. Yang WT, Suen M, Ahuja A, Metreweli C. In vivo demonstration of microcalcification in breast cancer using high resolution ultrasound. Br J Radiol 1997;70(835):685-90.
6. Soo MS, Baker JA, Rosen EL. Sonographic detection and sonographically guided biopsy of breast microcalcifications. AJR Am J Radiol 2003 April;180:941-8.
7. Cheung YC, Wan YL, Chen SC, Lui KW, Nq SH, Yeow KM et al. Sonographic evaluation of mammographically detected microcalcifications without a mass prior to stereotactic core needle biopsy. J Clin Ultrasound 2002 Jul-Aug;30(6):323-32.
8. Marini C, Traino C, Cilotti A, Roncella M, Campori G, Bartolozzi C. Differentiation of benign and malignant breast microcalcifications. Radiol Med 2003 Jan;105(1-2):17-26.
9. American College of Radiology. Breast imaging reporting and data system (BI-RADS), 3rd ed. Reston, VA: American College of Radiology, 1998.
10. Cleverley JR, Jackson AR, Bateman AC. Pre-operative localization of breast microcalcification using high-frequency ultrasound. Clin Radiol 1997 Dec;52(12):924-6.
11. Kopans Daniel B, Chapter 25 the breast Imaging report: Data management and breast Imaging Audit, Kopans Daniel B., Breast Imaging/Daniel B.Kopans,2007, 3rd edition, Philadelphia, Lippincott Williams & Wilkins. p. 983.