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"Role of ultrasound and ultrasound guided biopsy in the evaluation of mammographically proved breast calcifications."

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Abstract:

Objective: To evaluate the capability of ultrasound imaging to detect and guide biopsies of mammographically suspicious microcalcifications and to detect the histologic outcomes of the lesions.

Methods: The study was conducted on 30 patients referred to the Radiology Department at Alexandria Main University Hospital for assessment of palpable breast lumps or screening mammogram with accidentally discovered breast lesions. Each patient was subjected to full history taking, clinical examination, laboratory investigations e.g., bleeding time, mammography, and ultrasound. Ultrasound guided biopsy was done for the visible ones while lesions were not depicted on ultrasound were sent for mammographically guided wire localization with surgical excision.

Results: In 26 cases, there were sonographically visible microcalcifications which were seen on the background of associated hypoechoic masses or area of sonographically distorted parenchyma. The associated lesions were smaller in size in comparison with the corresponding mammographic abnormality in 64%.

Calcifications were seen as tiny strongly echogenic non shadowing foci. All sonographically visible calcific foci were less in their number than in mammogram.

The larger the cluster size, the more visible sonographically, 100% of clusters equal or more than 2 cm long were sonographically visible.

Conclusion: Targeted ultrasound is an effective method for the characterization of microcalcifications. Ultrasound sensitivity for breast density categories III and IV is higher than the mammographic sensitivity. Visibility of malignant microcalcifications improves when the size of the clustered microcalcifications is greater than 10 mm.

Keywards: Breast, Calcifications, Ultrasound, Biopsy.

1. Introduction

Breast cancer can be detected by means of two most widely used diagnostic methods, i.e., mammogram and ultrasound. [1] Breast calcifications may be the only detectable sign of early breast cancer, and are important finding on the breast mammography. [2] Microcalcifications may be a sign of pre-cancerous changes or early breast cancer.[3-5] It should be categorized according to The American College of Radiology Breast Imaging Reporting And Data System (ACR-BIRADS) into: (1) Typically benign. (2) Intermediate concern. (3) Higher probability of malignancy. [6]

It is important to analyze the microcalcifications regarding its morphology ,which is the most important factor in the differentiation between benign and malignant, the distribution (Diffuse or Scattered, Regional, Clustered, Segmental.) and the change over time.

The suspicious microcalcifications seen on mammogram are needed to be assessed by either stereotactic guided biopsy or by surgical excision after mammographically guided wire localization. [7] However ultrasound imaging has an important rule to guide either the biopsy or the wire localization prior to the excisional biopsy of the masses, and it is preferable more than mammographically guided techniques as the breast is not compressed, the procedure is more comfortable and faster, no ionizing radiation is used, additionally, the needle can be visible in real time with the ultrasound. [7, 8]

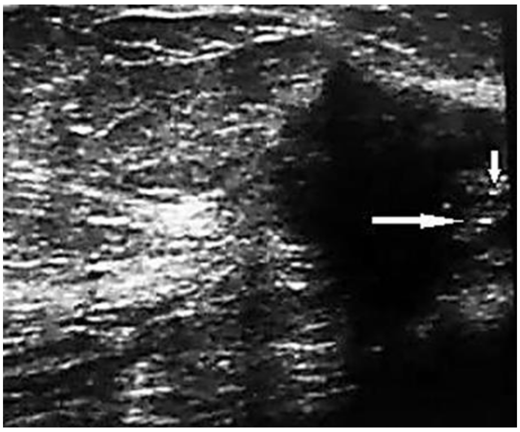
In presence of a high-frequency ultrasound, it is currently better to identify sonographic calcifications in addition to other associated changes including solid masses, focally dilated ducts or intraductal mass. Ultrasound imaging is used successfully to guide the biopsy of such lesions. [9-11] Although it has some critical limitations especially if the microcalcifications are isolated without an underlying mass, there are conditions when a percutaneous stereotactic biopsy is not accessible or hard to use as lesions in thin breast tissue, close to the chest wall or in the axillary tail. That’s why the procedure could be converted to a ultrasound guidance if possible. [12]

The aim of the work is to evaluate the ability of ultrasound to detect and guide biopsies of mammographically suspicious microcalcifications and to reveal the mammographic features and histologic outcomes of lesions amenable to sonographically guided biopsy.

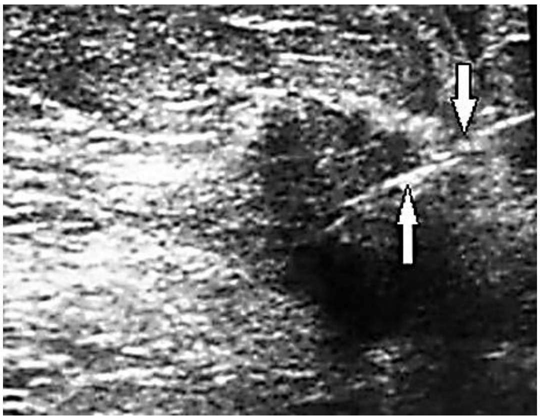
2. Materials and methods:

The study was conducted on 30 patients referred to the Radiology Department at Alexandria Main University Hospital for assessment of sensible breast lumps or screening mammogram with accidentally discovered breast lesions. Each patient was subjected to full history taking, clinical examination, laboratory investigation e.g., bleeding time, mammography, and ultrasound. Lesions that are visible on ultrasound subsequently underwent ultrasound guided percutaneous core biopsy, while lesions that were not depicted on ultrasound were sent for mammographically guided wire localization with surgical excision.

3. Cases:



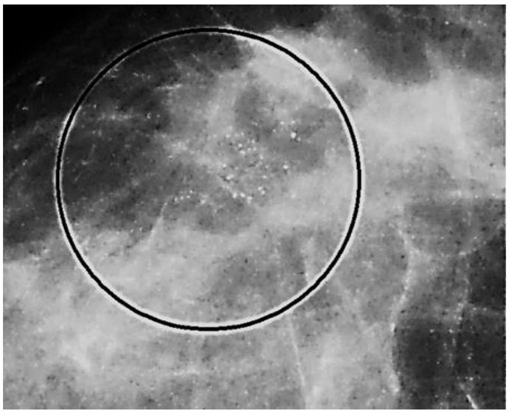
(a)



(b)

Case1: 61y female patient presented by mass sensation. Patholgically Proved to be IDC (NOS) grade II

(a) Ultrasound breast showing hypoechoic mass lesion of BIRADS-V with echogenic foci representing the calcific spots (b) Ultrasound image shows the needle targeting the calcific area.



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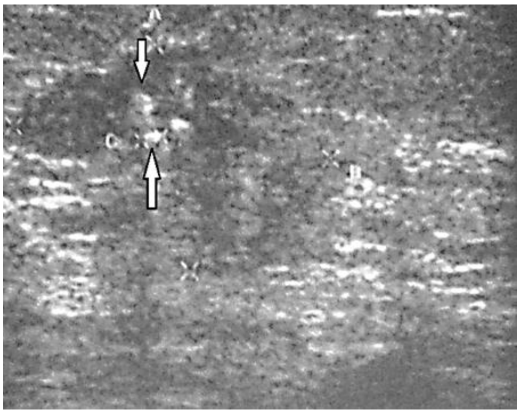
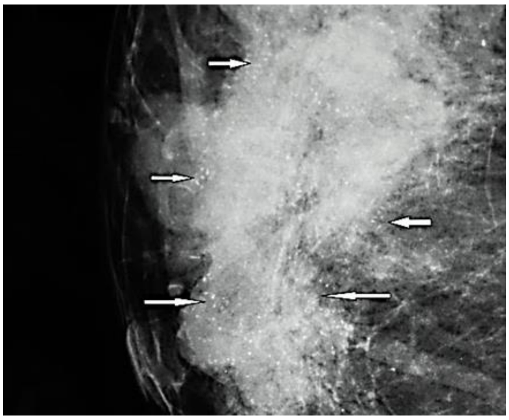


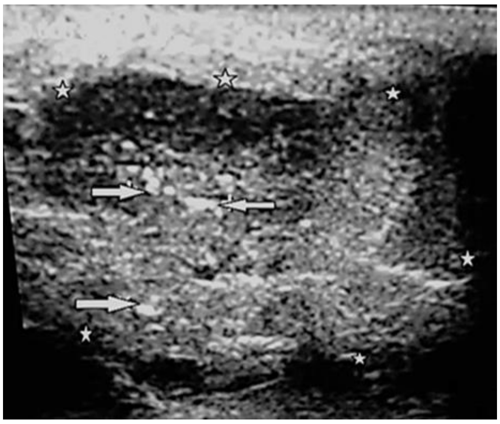
(b)

Case2: 51y female patient presented by palpable mass. Pathologically proved to be ILC

(a) mammogram shows round shape cluster of fine pleomorphic microcalcifications.

(b) Targeted US shows echogenic microcalcifications within hypoechoic, irregular shape ill-defined mass with diffuse posterior shadowing.



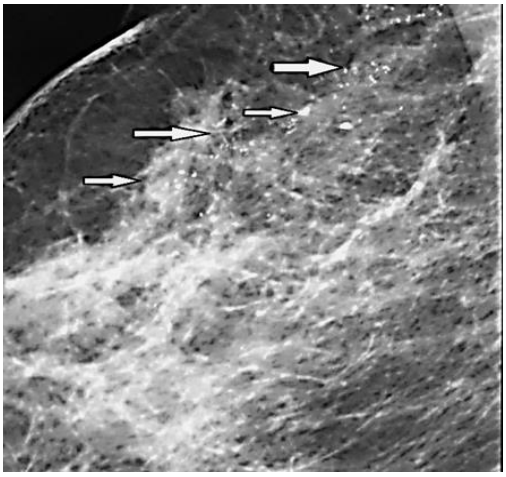


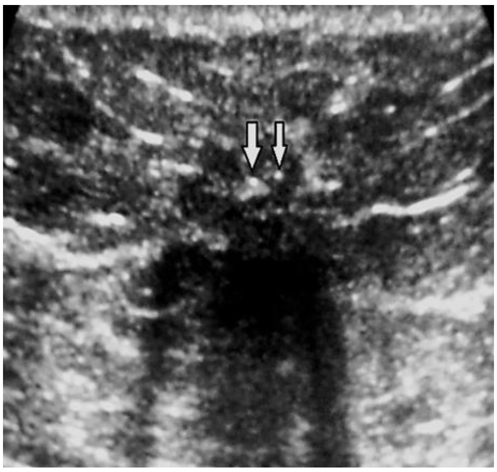
(a) (b)

Case3:54y female patient presented by mass sensation. Pathologically proved to be IDC (NOS) grade III

(a) mammogram shows a sizable dense mass lesion, showing irregular shape with partially circumscribed, partially obscured margin, associated with extensive regional fine pleomorphic microcalcifications

(b) Targeted US shows echogenic microcalcifications within heterogenous, mainly hypoechoic, irregular shape mass with ill-defined margin and diffuse posterior shadowing.





(a) (b)

Case 4: 55y female patient presented by mass sensation. Pathologically proved to be Mixed IDC &ILC

(a) mammogram shows focal asymmetry, associated with segmentally distributed fine pleomorphic microcalcifications

(b) Targeted US shows echogenic microcalcifications within hypoechoic, irregular shape ill-defined mass with diffuse posterior shadowing.

3. Results:

<u>Distribution of the studied cases according to ACR:</u>

According to ACR criteria, most of the patients were identified as ACR II (60.0%), while 7 patients (23.3%) were identified as ACR I and 5 patients (16.7%) were identified as ACRIII (Table 1).

Table (1): Distribution of the studied cases according to ACR (n = 30)

	No.	%
ACR		
I	7	23.3
II	18	60.0
III	5	16.7
IV	0	0

<u>Distribution of the studied cases according to mammographic abnormalities:</u>

Of 30 mammographically suspicious microcalcification lesions, 15 lesions (50%) were identified as dense mass lesions with suspicious microcalcifications, 8 lesions (26.7%) were identified with focal asymmetry with suspicious microcalcifications, and 7 lesions (23.3%) were identified with only suspicious microcalcifications.

<u>Distribution of the studied cases according to the analysis of microcalcifications:</u>

All cases showed suspicious microcalcifications on mammogram. According to the cluster shape, 11 lesions (36.7%) were identified as irregular shape, 11 lesions (36.7%) were identified as rounded shape, 5 lesions (16.7%) were identified as oblong shape and 3 lesions (10.0%) were identified as linear shape.

According to the cluster size; 2 lesions (6.7%) were measured as less than 1 cm in its maximum dimension in both view, 16 lesions (53.3%) were measured ranging from 1cm till less than 2 cm , 4 lesions (13.3%) were measured ranging from 2cm till less than 5 cm, 7 lesions (23.3%) were measured ranging from 5cm till less than 10 cm and 1 lesion was measured as equal or more than 10 cm.

According to the number of calcific foci per cluster, most of our cases showed more than 20 calcific foci/cluster.

According to morphology of individual microcalcific foci, 26 lesions (86.7%) were identified as fine pleomorphic microcalcifications, 3 lesions (10.0%) were identified as amorphous microcalcifications and 1 lesion (3.3%) were identified as fine linear microcalcifications.

According to distribution of microcalcifications, 14 lesions (46.7%) were identified as cluster distribution, 7 lesions (23.3%) were identified as regional distribution, 5 lesions (16.7%) were identified as ductal distribution and 4 lesions (13.3%) were identified as segmental distribution.

Distribution of the studied cases according to BIRADS:

All cases showed suspicious features which indicated biopsy. According to BIRADS classification, 5 cases (16.7%) were classified as class IVa, 8 cases (26.7%) were classified as class IVb, 11 cases (36.7%) were classified as class IVc and 6 cases (20.0%) were classified as class V (Table 2).

All cases classified as BIRADS IVc &V were associated with sonographically visible microcalcifications, while 80% of BIRADS IVa lesions were non-visible sonographically.

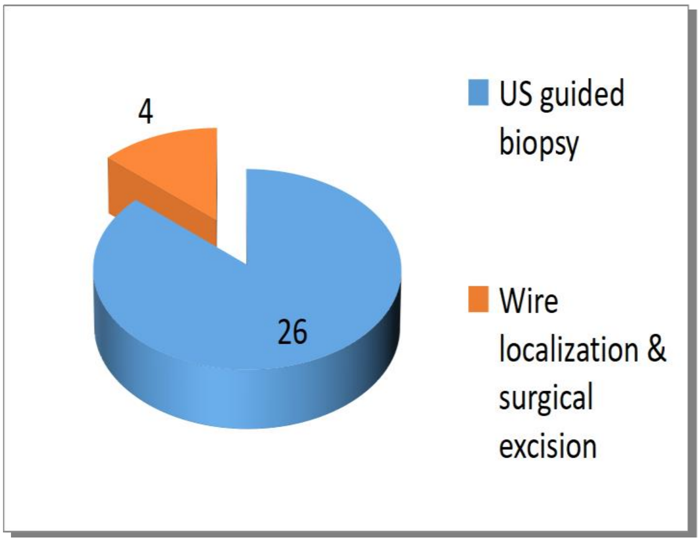
Table (2): Distribution of the studied cases according to BIRADS (n = 30)

	No.	%
BIRADS		
Iva	4	13.3
IVb	9	30.0
IVc	11	36.7
V	6	20.0

Distribution of the studied cases according to type of guided biopsy:

In 26 cases, there were sonographically visible microcalcifications which were seen on the background of associated hypoechoic masses or area of sonographically distorted parenchyma, for which ultrasound guided biopy was done. The remaining four cases were sent for wire localization and surgical excision (Figure 1).

Figure (1): Distribution of the studied cases according to type of biopsy



<u>Factors support the ability of ultrasound to visualize the mammographically detected microcalcifications:</u>

The sonographically visible microcalcifications were seen on the background of associated hypoechoic masses or area of distorted parenchyma. The associated lesions were smaller in size in comparison with the corresponding mammographic abnormality in 64%. Calcifications were seen as tiny strongly echogenic non shadowing foci. All sonographically visible calcific foci were less on their number than in mammogram.

The larger the cluster size, the more visible sonographically, 100% of clusters equal or more than 2 cm long were sonographically visible.

All cases with more than 20 calcific foci/cluster were sonographically visible. All regionally or segmentally distributed microcalcifications were sonographically visible. Sonographically visible calcifications were more common in invasive cancer than those not seen on sonography (92.3% vs 25%, respectively).

4. Discussion:

Due to increased awareness among the female population; regarding breast cancer prevention, millions of asymptomatic women began to undergo mammography screening each year which generated a considerable increase in the diagnosis of non-palpable breast lesions. [(13)]

Suspicious breast lesion should be confirmed by utilizing cyto-histological diagnostic tools that allow the lowest possible invasiveness. The availability of variable number of needle and biopsy probes enables the retrieval of breast tissue either from stereotactic, US or MRI-guidance. [(14)]

Several factors determine the choice of stereotactic versus US-guidance including equipment accessibility, visibility of the lesion and preferences of operator and patient. [15]

Most of our cases presented by mammographically occult masses (71.4%) were classified as ACR III and This in accordance with Azam et al. [16] who stated that for breast density categories III and IV, ultrasound sensitivity was significantly higher than that of mammography ($p = 0.03$).[16-18]

In our study, 71.4% of cases presented only by microcalcifications with no additional findings on sonography, and it was used to guide the biopsy, except for two lesions which were sonographically invisible and stereotactical guided wire localization and surgical excision was done.

In our study, the mammographic microcalcifications with large group size, large number of particles in the group and segmental distribution of the particles were visible by ultrasound.

Moon et al. said that the visibility of masses on ultrasound was much higher with suspicious microcalcifications, especially those larger than 10 mm. [17]

In our study, all sonographically visible calcific foci were less in number than in mammogram. Mary et al reported [18] that sonographically visible masses or ducts that contain microcalcifications are smaller in size than the corresponding mammographic group. In the current study, the number of echogenic foci that was seen on sonography (66.7%) was less than the number of calcific particles seen on mammography (100%).

Microcalcifications; detected on sonograph were more than three times as likely to be invasive than other lesions which could not be detected by ultrasound. Yeon et al. [19] stated that microcalcifications detected on US are more frequently associated with invasive cancer than those not seen on US. With the use of state-of-the-art US techniques, therefore, a substantial limitation seems to have been overcome. [20]

Lesions in our study had to be assessed for visualization of microcalcifications to undergo biopsy with sonographic guidance. So, we had to assess microcalcifications in the specimen under microscopy and compare them with the postoperative pathological diagnosis if available. The detection of microcalcifications under microscopy was in a small number of specimens.

Hatice et al. [21] reported that for “microcalcification only” breast lesions, the specimen that contains calcium would generate an accurate diagnosis in 99% of cases while Cores that contain no calcification hardly contribute to the diagnosis on their own. In 87% of cases an accurate diagnosis could still have been made even if the targeted calcification had been missed. [22,23]

One of the limitation of our study was the way in which calcifications were diagnosed histologically; only one pathologist evaluated the histologic specimens. Variable radiological studies suggested that double reading obviously improves the sensitivity for the detection of microcalcifications. Moreover, in our study, Von Kossa stain; the specific staining method for the detection of microcalcifications was not used in the present study. Additionally, microcalcifications may get lost during the preparation process as it was mentioned in different literatures.

We recommend further studies to compare sonographically guided biopsy vs stereotactically guided biopsy of equal-sized and equivalently categorized BI-RADS lesions; with a larger sample size and a randomized trial to verify which method results in less underestimation of disease.(23)

5. Conclusion:

Ultrasound guided biopsy is an effective method for the characterization of microcalcifications. The ability to define the malignant microcalcifications by ultrasound improves when the size of the clustered microcalcifications is greater than 10 mm and seen as tiny strongly echogenic non shadowing foci especially those associated with sonographic hypoechoic masses.

6. References:

1. Duan X., Qin G., Ling Q., et al. Matching corresponding regions of interest on cranio-caudal and medio-lateral oblique view mammograms. IEEE Access . 2019;7:31586–31597. doi: 10.1109/ACCESS.2019.2902854
2. Ultrasonographic detection and characterization of asymptomatic ductal carcinoma in situ with histopathologic correlation Acta Radiol May 1, 2011, 52:4 364-371.
3. Cruz-Bernal A., Flores-Barranco M. M., Almanza-Ojeda D. L., Ledesma S., Ibarra-Manzano M. A. Analysis of the cluster prominence feature for detecting calcifications in mammograms. Journal of healthcare engineering . 2018;2018:11. doi: 10.1155/2018/2849567.2849567
4. Sushovan Chaudhury, Manik Rakhra, Naz Memon et al. Breast Cancer Calcifications: Identification Using a Novel Segmentation Approach. Comput Math Methods Med. 2021; 2021: 9905808.
5. Ultrasound as an Adjunct to Mammography for Breast Cancer Screening: A Health Technology Assessment. Ontario health technology assessment series Health Quality Ontario 2016; 16:1–71.

6. Rao AA, Feneis J, Lalonde C, Ojeda-Fournier H. A pictorial review of changes in the BI-RADS fifth edition. Radiographics. 2016;36:623–39.
7. Mayo RC, 3rd, Kalambo MJ, Parikh JR. Preoperative localization of breast lesions: current techniques. Clin Imaging. 2019;56:1–8. doi: 10.1016/j.clinimag.2019.01.013.
8. Chen L., Jagota V., Kumar A. Research on optimization of scientific research performance management based on BP neural network. International Journal of System Assurance Engineering and Management. . 2021 doi: 10.1007/s13198-021-01263-z.
9. An YY, Kim SH, Kang BJ, Lee AW. Comparisons of Positron Emission Tomography/Computed Tomography and Ultrasound Imaging for Detection of Internal Mammary Lymph Node Metastases in Patients With Breast Cancer and Pathologic Correlation by Ultrasound-Guided Biopsy Procedures. Journal of ultrasound in medicine : official journal of the American Institute of Ultrasound in Medicine 2015; 34:1385–94
10. Sanderink WBG, Laarhuis BI, Strobbe LJA, et al. A systematic review on the use of the breast lesion excision system in breast disease. Insights Imaging. 2019;10:49. doi: 10.1186/s13244-019-0737-3.
11. Acta Radiol 2010 Mar;51(2):123-7. Ultrasonography-guided vacuum-assisted biopsy of microcalcifications: Comparison of the diagnostic yield of calcified cores and non-calcified cores on specimen radiographs. Cho N, Moon WK, Chang JM, Park SH, Lyou CY, Park IA.Source: Department of Radiology and Clinical Research Institute, Seoul National University Hospital, Seoul, Republic of Korea.
12. Qiao M., Guo Y., Zhou S., Chang C., Wang Y. Breast calcifications detection based on radiofrequency signals by quantitative ultrasound multi-parameter fusion. 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2019; Berlin, Germany.
13. Claire E Wright, Michelle Harvie, Anthony Howell, D Gareth Evans, Nick Hulbert-Williams and Louise S Donnelly. Beliefs about weight and breast cancer: an interview study with high-risk women following a 12-month weight loss intervention. Hereditary Cancer in Clinical Practice 2015, 13:1.
14. Usami S, Ohnuki K, Watanabe M, Umemura A, Takagi M, Asano S, et al. Current status and problems of simultaneous screening with mammography and ultrasound (Japanese) Jpn AssocBreast Cancer Screen. 2018;27(1):51–55. doi: 10.3804/jjabcs.27.51.

15. Jisook Yi, MD,1 Eun Hye Lee, MD, 1 Jeong Ja Kwak, MD,2 Jang Gyu Cha, MD. Retrieval Rate and Accuracy of Ultrasound-Guided 14-G Semi-Automated Core Needle Biopsy of Breast Microcalcifications.Korean J Radiol. 2014 Jan-Feb;15(1):12-19.
16. Azam S, Eriksson M, Sjölander A, Hellgren R, Gabrielson M, Czene K, et al. Mammographic density change and risk of breast cancer. J. Natl Cancer Inst. 2020;112:391–9.
17. Enas A. Abdel-Gawad, Osama A. Khalil , Sara M. Ragaee .Assessment of breast lesions using BI-RADS US lexicon in mammographically dense breasts (ACR categories 3 and 4) with histopathological correlation The Egyptian Journal of Radiology and Nuclear Medicine. Volume 45, Issue 4, December 2014, Pages 1301–1307.
18. Teh WL, Wilson ARM, Evans AJ, Burrell H, Pinder. SE, Ellis IO. Ultrasound guided core biopsy of suspicious mammographic calcifications using high frequency and power Doppler ultrasound. Clin Radiol 2000; 55:390–4.
19. Mary Scott Soo, Jay A. Baker, Eric L. Rosen. Sonographic Detection and Sonographically Guided Biopsy of Breast Microcalcifications AJR 2003; 180:941–948.
20. Geiger-Gritsch S, Daniaux M, Buchberger W, Knapp R, Oberaigner W. Performance of 4 years of population-based mammography screening for breast cancer combined with ultrasound in Tyrol/Austria. Wien Klin Wochenschr. 2018;130(3–4):92–99. doi: 10.1007/s00508-017-1293-9.
21. Hatice Gümüş MD1, Pippa Mills MD2, David Fish MD3, Metehan Gümüş MD4,Haresh Devalia MD5, Sue E. Jones MD6and Ali R. Sever MD7 Breast Microcalcification: Diagnostic Value of Calcified and Non-calcified Cores on Specimen Radiographs. The Breast Journal 2013 Volume 19, Issue 2, pages 156–161.
22. Yu CC, Cheung YC, Ueng SH, et al. Impact of Non-Calcified Specimen Pathology on the Underestimation of Malignancy for the Incomplete Retrieval of Suspicious Calcifications Diagnosed as Flat Epithelial Atypia or Atypical Ductal Hyperplasia by Stereotactic Vacuum-Assisted Breast Biopsy. Korean J Radiol 2020;21:1220-9.
23. Y.T. Sim, J. Litherland, E. Lindsay, P. Hendry, K. Brauer, H. Dobson, C. Cordiner, T. Gagliardi, L. Smart. Upgrade of ductal carcinoma in situ on core biopsies to invasive disease at final surgery: a retrospective review across the Scottish Breast Screening Programme. Clinical Radiology.Volume 70, Issue 5, May 2015, Pages 502–506.