Added advantage of automated breast ultrasound in the detection of breast lesions in mammographically dense breast

Poster No.:	C-1412
Congress:	ECR 2019
Type:	Scientific Exhibit
Authors:	N. A. E. H. ElDeib, E. A. Aly, A. M. A. Elmosselhy; Cairo/EG
Keywords:	Breast, Ultrasound, Image compression, Staging, History, Cancer
DOI:	10.26044/ecr2019/C-1412

Aims and objectives

The aim of this study is to assess the ability of ABUS to detect mammographically occult breast lesions at dense breasts. Assessing the diagnostic parameters of ABUS compared to digital mammography as well as HHUS in detection of breast lesions in dense breast. The secondary outcome is to prove the effectiveness of using ABUS as a screening tool in dense breasts in BIRADS 0 mammographic results

Methods and materials

1-Methods and Materials

This prospective study was performed in the Female Imaging Unit of the National Cancer Institute (N.C.I), Cairo University; all the included cases gave informed consent.

The study was conducted on 59 patients with 64 lesions presented to the NCI with either palpable breast mass or as a part of early screening starting from January 2017 till July 2018. Their ages ranged from 24 to 81 years (mean age :41 ± 10 SD years). Three cases were represented with bilateral lesions and two cases had two lesions at the same breast.

INCLUSION CRITERIA:

Dense breast (ACR C or ACR D) on digital mammography.

EXCLUSION CRETERIA:

Breasts with ACR A(predominantly fatty breast)or ACR B (scattered glandular tissue)on digital mammography were excluded.

All of the cases (n=59) were subjected to both digital mammography and Automated breast ultrasound ,as well as routine hand held ultrasound . They were asked to expose the upper part of the body. No other special preparations were needed.

a) Digital mammography examination protocol design:

A craniocaudal (CC) and a medio-lateral oblique (MLO) view were obtained with the patient in a standing position. Breast compression was applied.

b) Automated breast examination protocol design:

AllparticipantsunderwentABUSexamination.Thetransducer lengthis15.3cm,with6-15MHzfrequency.The grayscalelevelsare256withframerate10frame/second.The examination was performed in the supine position.

A cushion was placed under the shoulder that helped to spread out the breast tissue evenly, with the nipple pointing to the ceiling. A hypo allergenic lotion was placed evenly on the breast with an additional amount on the area of the nipple.

A disposal membrane was used to aid an acoustic coupling and one of the three levels of compression was applied to spread out the breast evenly with respect to image quality and patient comfort. The ABUS scan was continuous and automated. During the acquisition women were asked not to move and to breathe smoothly.

Volume acquisitions were obtained in the axial plane starting from the inferior part of the breast with coronal and sagittal reconstruction.

Image data automatically acquired a 15.4 cm x 17.0 cm volume from the skin to the chest wall up to 5 cm deep with 0.2mm thickness of each slice. For each breast, three volumes were obtained: the central (anteroposterior) volume with the nipple in the center of the footprint , the lateral volume that included the upper outer part of the breast tissue with the nipple located in the inferior-medial corner and the medial volume that included the inner and inferior part of the breast tissue. A nipple marker was placed in every examination for accurate coordinance. For optimal image quality a selection between three breast sizes was made. In women with larger breasts additional views were taken to avoid tissue exclusion.

c)Handheld ultrasound images:-

Gel is applied to breasts and ultrasound examination was done using radial and anteradial techniques with axilla US examination.

Using ultasound device with probe frequency 18-5MHz and footprint 3.89 cm

2- IMAGE ANALYSIS:

The digital mammography and automated ultrasound data were evaluated by two experienced radiologists in consensus; both observers were unaware of the pathological data of each patient.

Digital mammography images:-

Assessment of breast composition, mass characterization (shape, margin density), asymmetry, calcification, mass number, location, axillary lymphadenopathy, extension, skin thickening, retraction and extension architectural distortion, BIRADS classification were done.

Automated ultrasound images(ABUS) and Handheld ultrasound(HHUS)images:-

Assessment of mass characterization (shape, margin orientation, echopattern, posterior feature, calcification), mass number, location, axillary lymphadenopathy,

skin thickening, retraction and BIRADS classification were done. Additionally for ABUS we assessed lesions' character in coronal view.

All breast masses included in this study were interpreted as above described and then the accuracy in reaching the final diagnosis was calculated for ; digital mammography and Automated Ultrasound as well as HHUS.

Pathological results were used as the gold standard of reference for the 64lesions.Samples were obtained with fine needle aspiration cytology (FNAC),cytology from nipple discharge, core biopsy, surgical excision and radical surgery. Analysis of the samples was performed in the pathology department of the Egyptian National Cancer Institute by a group of well-trained expert pathologists.

Apart from 13 lesionswhichwere proven to benign byfollow upafter 6 months(BIRADSIII)

3- STATISTICAL ANALYSIS:

Data were coded and entered using the statistical package SPSS (Statistical Package for the Social Sciences) version 25. Data was summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data.

Comparisons between quantitative variables were done using the non-parametric Mann-Whitney test . For comparing categorical data, Chi square (c2) test was performed. Exact test was used instead when the expected frequency is less than 5 . Correlations between quantitative variables were done using Spearman correlation coefficient . Standard diagnostic indices including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic efficacy were calculated as described by **.** Testing for agreement between different methods in numerical data was done using the Intra Class Coefficient (ICC) with 95% confidence interval (95%CI) **.** P value less than 0.05 was considered as statistically significant.

Results

Patient'sdemographics:

Thisprospectivestudyincludedatotalof59patientswith64lesionspresentedtotheNCIwithbreastmasses(det
age:41 ± 10 SD years).

Out of 59 patients 64 masses were detected, 36 cases(56.2%) were diagnosed as benign while 28(43.8%) cases were diagnosed as malignant.

Pathological results was used as the gold standard of reference apart from 13 lesions which were proven by to be benign by follow up(BIRADS III to BIRADS II).

Each examination (digital mammography ,ABUS and HHUS) was evaluated regarding the following criteria according to 5th edition of BIRADS lexicon.

I. Digital mammography

As regarding lesions detection 25 lesions (39.1%)out of 64 lesions were not detected by mammography 14(56%) of them were benign and 11 (44%) of the were malignant.

As regarding breast density 44 (68.8%) of breasts examined were ACRC, while 20 (31.2%)were ACR D. No significant correlation in our study between glandular tissue composition breast and malignancy(**P value** 0.221).

In our study, 24 cases were categorized as BIRADS 0 by mammography due to high breast density(14 of them were benign and 10 were malignant), in 2cases there was malignant masses with no any abnormal criteria at mammography, in 7 cases there was only global asymmetry with no underlying mass by mammography malignant lesions were detected by ABUS and HHUS, in 1case the only suspicious criteria by mammography was focal asymmetry.one case with no abnormal finding at mammography was diagnosed as ADH which is not a malignant mass but categorize the patient as high risk

II.HHUS

As regarding lesions detectability it was higher than mammography it could detect 15 lesions missed by mammography, however it was lower than ABUS,ABUS could detect duct papilloma interpreted by HHUS as dilated ducts, and the second lesion

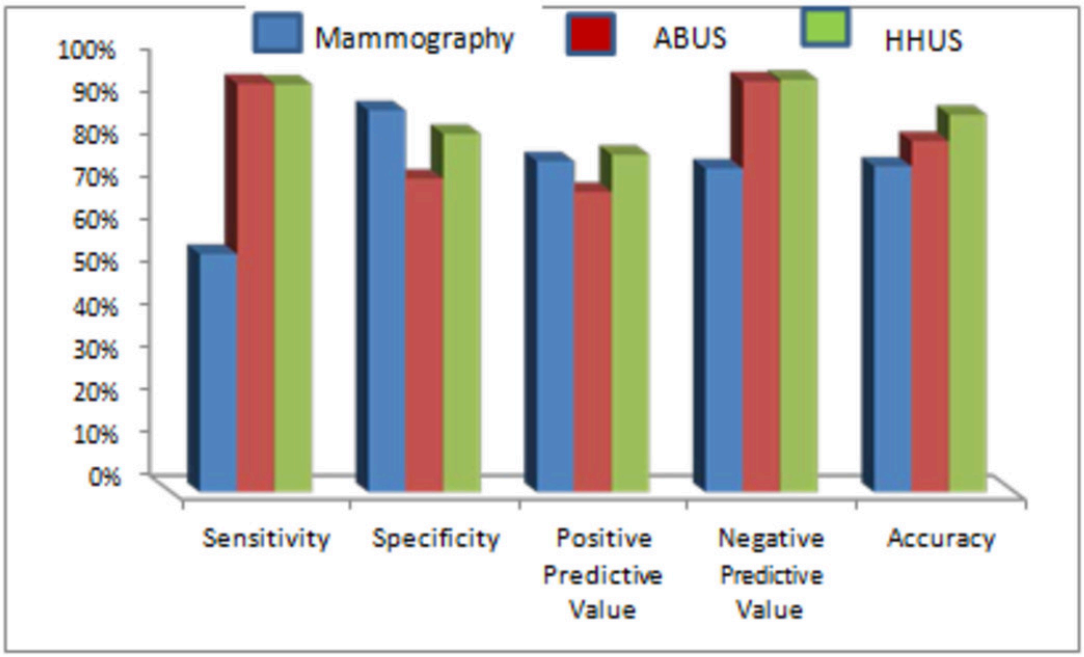
was retroarolar lesion interpreted by HHUS as dilated ducts with increased internal vascularity.

III.ABUS

As regarding lesions detectability it was highest by ABUS it could detect 17 lesions missed by mammography, and 2 lesions missed by HHUS.

As regarding lesions margins in coronal view (which is unique for ABUS),21(32.8%) lesions showed retraction phenomenon(all were malignant 100%) ,21(32.8%) lesions showed complete hyperechoic rim(19(90.5%) were benign),14(21.9%) lesions showed incomplete(discontinuous) hyperechoic rim(9(64.3%) were benign while 5 (35.7%)were malignant) ,no masses were detected in 8(12.5%) cases. **Sensitivity of retraction phenomenon for malignancy was 75%,while specificity was 100%.Specficity of complete hyperechoic rim for benign lesions was 90.5%,,while sensitivity was for benign lesion detection was 52.8%.**

Images for this section:



comparison between statistics of mammography ABUS and HHUS

Fig. 1

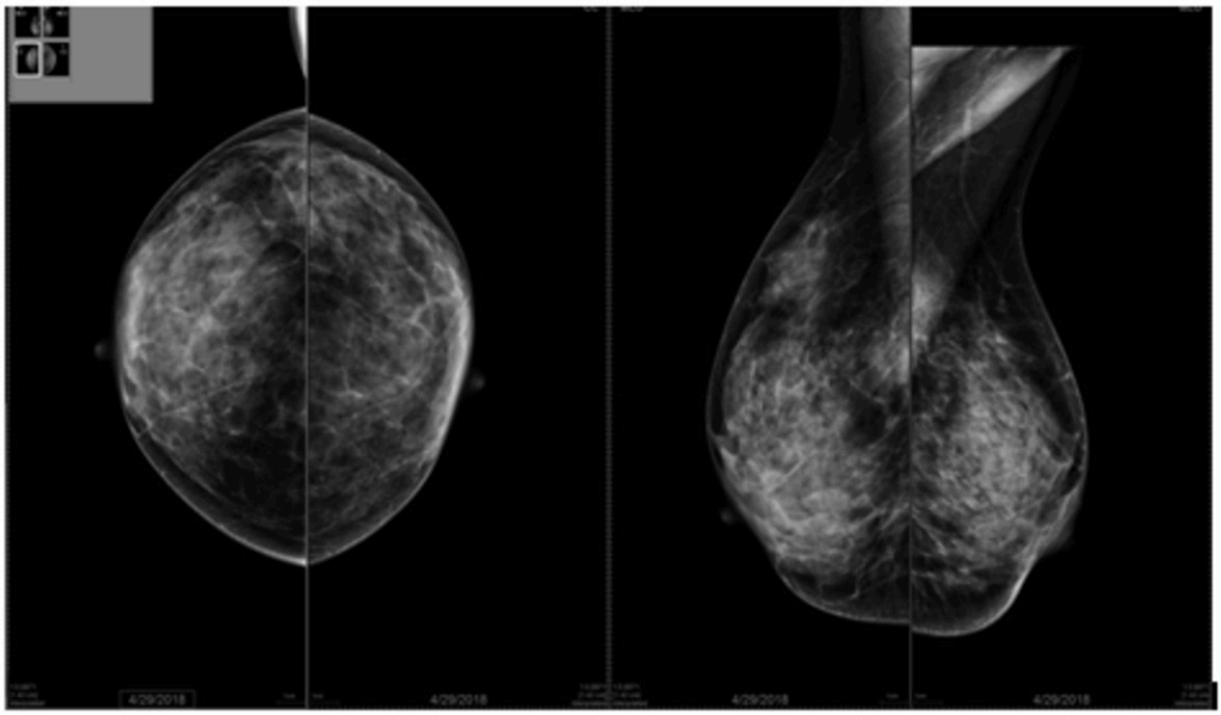


Fig .case Mammography,MLO and CC views revealed no mass lesion (BIRADS 0)

Fig. 2

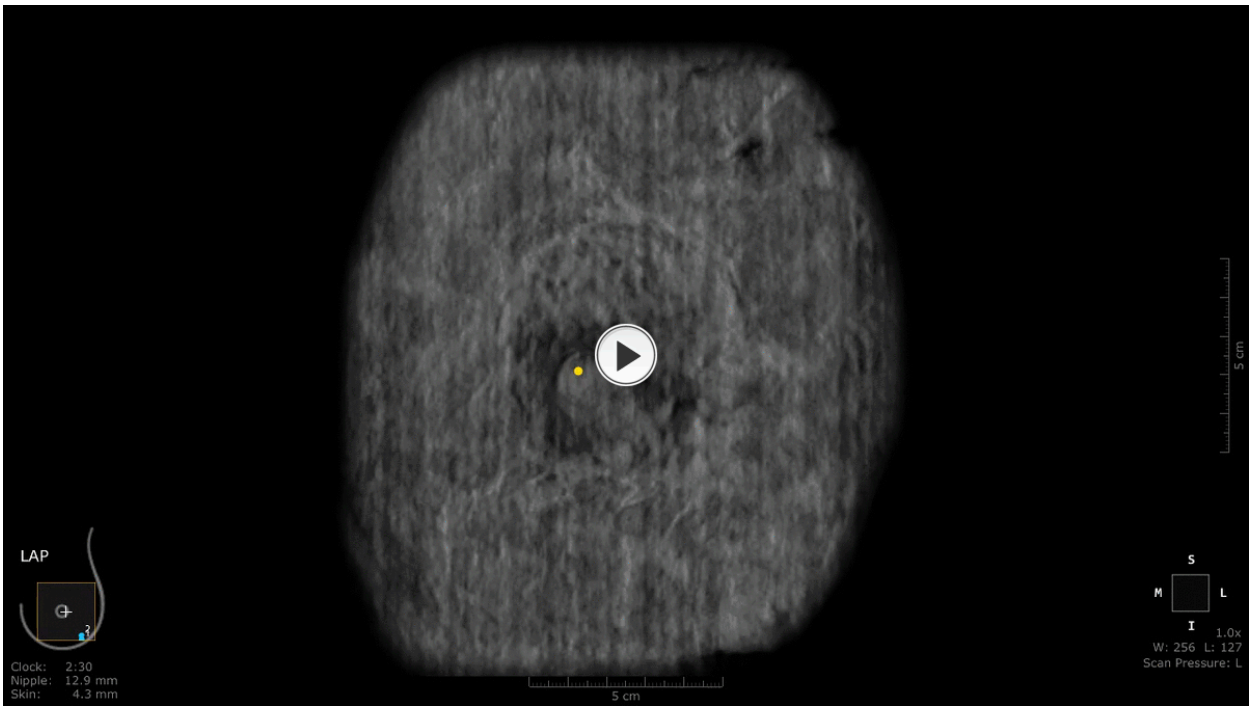


Fig. 3

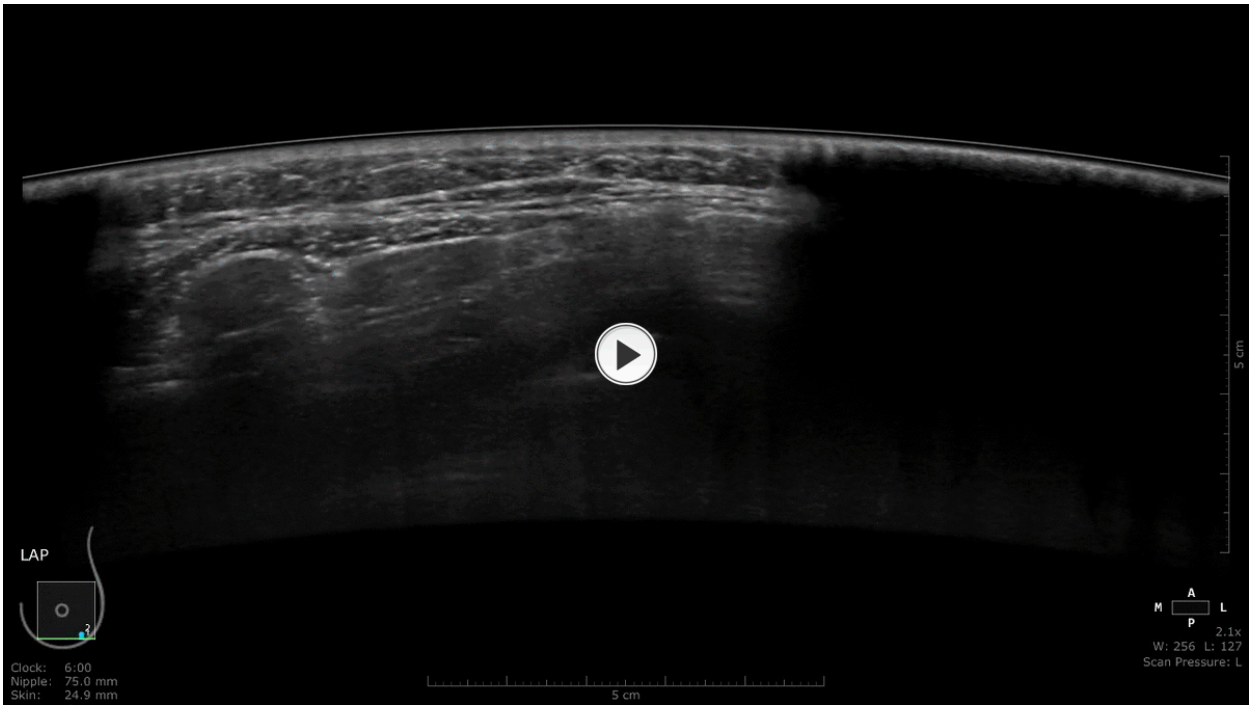


Fig. 4

Fig. 5

Conclusion

ABUS can detect mammographically occult breast lesions ,accurately detects lesion location and size. It has sensitivity higher than HHUS ,but less accuracy and specificity. However, it is reproducible ,non operator dependent ,and less time consuming for radiologist. DM should be used in combination with ABUS due to the high capability of DM to detect microcalcifications. ABUS is a new promising tool that can be implemented in dense breast workup as a screening tool as well as diagnostic tool.

Personal information

- **Prof. Noha Abdel Shafy El Said (Professor of diagnostic and interventional radiology,National Cancer Institute,Cairo unversity).**
- **Dr Engy Adel Aly(Lecturer of diagnostic and interventional radiology,Faculty of Medicine Kasr Al Aini,Cairo unversity)**
- **Alaa Mohammed Ahmed Elmosselhy(Msc,Faculty of medicine, Cairo University,Radiology resident ,NCI,Cairo university)**

References

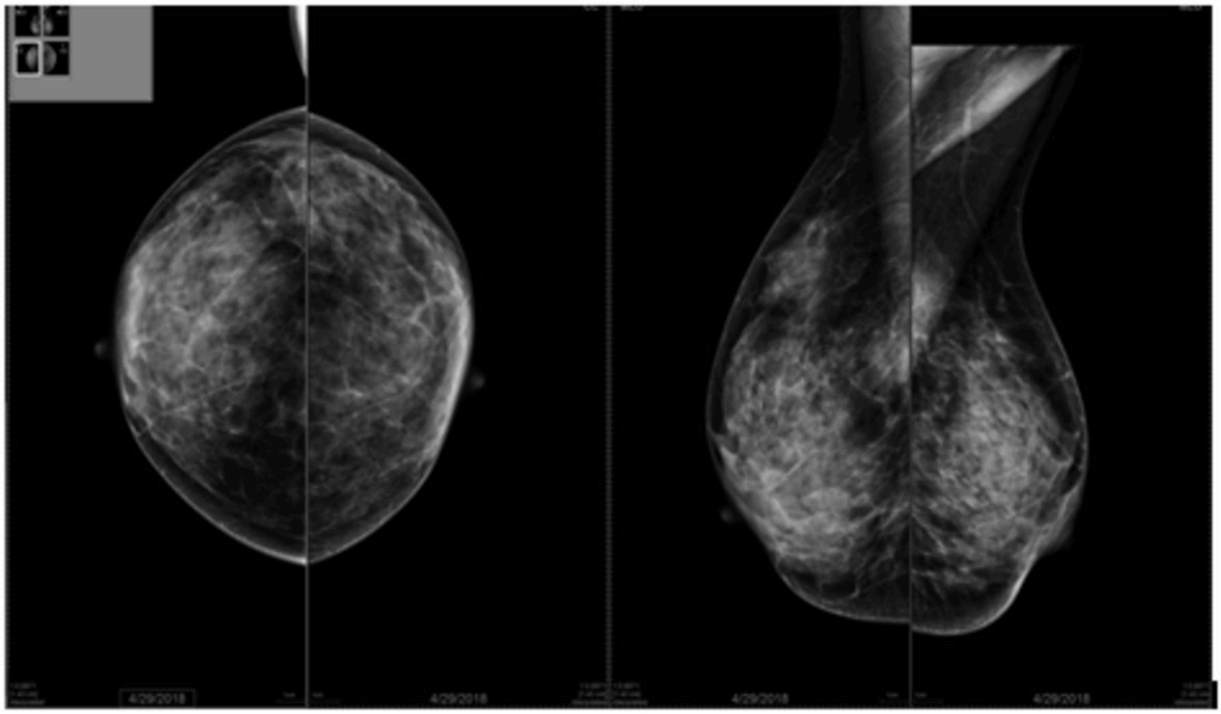


Fig (1): .case 4 Mammography,MLO and CC views revealed no mass lesion (BIRADS 0)

Fig. 2
References: department of Radiology,NCI,Cairo university ,2018