Role for Automated Breast Volume Scanner (ABVS) in dense breast with normal mammography

Poster No.: C-1583
Congress: ECR 2017
Type: Educational Exhibit
Authors: M. Zanotel, A. Nitti, L. Tomkova, V. Londero, R. Girometti, A. Linda, C. Zuiani; Udine/IT
Keywords: Cancer, Diagnostic procedure, Ultrasound, Breast
DOI: 10.1594/ecr2017/C-1583

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

To be aware of the added value of ABVS in women with dense breast and normal mammography.

To familiarize with pitfalls of ABVS as a potential source of false positives (FP).
Background

ABVS is a recently introduced technique in which standardized image sets are obtained by an ultrasound (US) system provided with a linear array transducer attached to a mechanical arm. After exam acquisition, image sets are sent to a dedicated workstation and reformatted on sagittal, transverse and coronal plane [1,2].

Actually, ABVS is principally used as alternative to traditional handheld ultrasound (HHUS) screening.

Because of the known limitations of mammography in dense breasts, supplemental screening is needed.

HHUS has been reported having an important role as adjunctive screening tool in dense breasts. The most important study was published by Berg et al., reporting a supplemental yield of 4.2 per 1000 women screened [3].

This study, however, reveals some "weak points" of HHUS screening, such as high number of false positives (FP) and the considerable effort in terms of physician time for exam execution and interpretation [3].

Due to these limits, technological research tried to propose US machines able to standardize and simplify US examination.

In this setting, ABVS could become the method of choice thanks to its advantages over HHUS (higher reproducibility, less operator dependence, multiplanar reconstructions). [1]

Expected role of screening with ABVS is to increase detection of mammographically occult breast cancers, as already demonstrated by several studies [4, 5-7, 8].

First studies about the role of ABVS for screening purpose were published by Kelly et al. [4] who performed one multicenter prospective study comparing mammography alone versus automated whole breast ultrasound plus mammography in 4,419 women with dense breasts and/or at elevated risk of breast. An additional 3.6 cancers per 1,000 women screened was found. Sensitivity of the automated whole breast ultrasound alone was 67% and that of mammography alone was 40%; sensitivity of the combined modality was 81% [4].

More recently, two large studies were published about ABVS screening. Brem et al. [5] evaluated more than 15,000 asymptomatic women with dense breasts using mammography and supplemental automated breast ultrasound. They found that mammography detected 5.4 cancers per 1000 women, whereas mammography with supplemental automated breast ultrasound detected 7.3 cancers per 1000 women, causing an increase of 1.9 cancers per 1000 women. An increase of 26.7% in sensitivity was reported for the combined imaging approach versus mammography alone. There
was a corresponding increase in the recall rate, from 150 per 1000 women with mammography to an additional 135 per 1000 women with automated breast ultrasound, a specificity decrease of 13.4%. The additional cancers detected with automated breast ultrasound (93.3%) were invasive node-negative breast cancers, then disease at early stage [5].

Recall rate, however, is expected to be reduced increasing the experience of readers and technologists acquiring the images [6].

Wilczek et al. [7] evaluated 1668 asymptomatic women, with etherogeneously/extremely dense parenchyma. The combined full field digital screening mammography (FFDSM) and automated breast ultrasound generated in increase of 2.4 detected cancers per 1000 women screened. The corresponding recall rate per 1000 women screened was 13.8 for FFDSM alone and 22.8 for combined FFDSM and automated breast ultrasound, yielding a difference of an additional 9.0 recalls per 1000 women screened.

In relation to the problem of increase in the recall rate Arleo et al. [8], in their retrospective cohort study, at the end of the "first quarter" of ABVS use (as screening tool in women with dense breasts), reported an overall recall rate of 19% during the 3-month study time period, with specifically, the recall rate trended down from 24.7% in the first month to 12.6% in the third month. These results confirm the clinical implication that ABVS does have a learning curve [8].

Finally, in a recent study by Giger et al. [9] comparing full field digital mammography with automated breast ultrasound to full field digital mammography alone for mammography-negative cancers, the addition of automated breast ultrasound caused a 23.9% sensitivity increase. The authors reported an overall specificity of 76.1 for full field digital mammography with automated breast ultrasound, higher than previously reported [5], thanks to a robust training program provided to the interpreting physicians, which helped to minimize false-positives.
Findings and procedure details

Exemplar ABVS cases from our experience, identified in women with dense breast (heterogeneously/extremely dense), were selected in order to highlight common themes of relevance to clinical practice including: the type of lesions frequently made more perceptible by ABVS; the histologic findings (both true posives and FP) of ABVS-only detection. All cases were histologically-proven

ABVS acquisition details

The ABVS integrated system (ACUSON S2000, ABVS Ultrasound System, Siemens) utilizes a flat transducer (5-14 MHz bandwidth) mounted on a flexible arm. Each scan view covers a surface of 15.4 cm x 16.8 cm with a scan depth up to 6 cm. Slice thickness is 1 mm. The selection of breast cup (A-D) is needed before acquisition in order to let ABVS automatically adjust various settings (gain, frequency, depth) for better image optimization. The patient lies in a supine position and the transducer is applied with a tender compression on the breast in three main views: anterior-posterior (AP), lateral and medial. If needed, for example in case of large breasts, additional views can be acquired: superior and inferior view or as well special views targeted on the single quadrant with a suspicious finding. All views have to contain nipple as a reference point. Technically well-executed exam provides consistent, reproducible, operator-independent ultrasound imaging of the entire breast. The images are evaluated on a 3D work station connected to ABVS where multiplanar reconstructions are available. Whole exam of both breasts (standard 3 projection per breast) lasts about 15 minutes and the evaluation of a negative bilateral exam takes about 3-4 minutes by experienced reader.

Findings - diagnostic approach

Cases were selected from our clinical routinary practice from women presenting heterogeneously/extremely dense breast parenchyma on mammography. Suspicious breast lesions seen on ABVS were evaluated through BI-RADS US criteria [10] and compared to the final pathological result.

Findings - clinical cases

Case 1. Negative mammogram in a 37 year old woman with extremely dense breast parenchyma (Figure 1 a, b) and a palpable lump on the left breast. ABVS (Figure 1 c, d, e) shows an hypoechoic nodule with irregular shape and margins (U4b) on the outer periareolar zone of the left breast. This ABVS-detected breast cancer was shown to be an invasive ductal carcinoma (grade 2) associated with ductal carcinoma in situ (DCIS), without lymph node metastases.
Case 2. Negative mammogram in a 60 year old woman with heterogeneously dense breast parenchyma (Figure 2 a, b) and a right breast palpable lump. ABVS (Figure 2 c, d, e) shows an heterogeneously hypoechoic nodule with irregular shape (U4b) between the outer quadrants of the left breast. This ABVS-detected breast cancer was shown to be a mixed ductal-lobular carcinoma, grade 2, without lymph node metastases.

Case 3. Negative mammogram in an asymptomatic 42 years old woman with extremely dense breast parenchyma (Figure 3 a, b). ABVS (Figure 3 c, d, e) shows an heterogeneously hypo-isoechoic nodule with echoic halo, irregular shape and indistinct margins (U5) on the inner-lower quadrant of the left breast. This ABVS-detected breast cancer was shown to be a 20 mm invasive lobular carcinoma, grade 2, without lymph node metastases.

Case 4. Negative mammogram in an asymptomatic 50 year old woman with extremely dense breast parenchyma (Figure 4 a, b) having personal screening. ABVS (Figure 4 c, d, e) shows an hypoechoic lesion with irregular margins (U4). Surgical biopsy revealed this ABVS-detected lesion to be an area of fibrosis and usual ductal hyperplasia.

Case 5. Negative mammogram in an asymptomatic 49 years old woman with disomogeneusly dense breast parenchyma (Figure 5 a, b) having routine screening. ABVS (Figure 5 c, d, e) shows an hinomogeneous hypoechoic area with indistinct margins (U4) on the inferior periareolar zone of the left breast. Ultrasound core needle biopsy revealed an area of fibrosis.

Case 6. Negative mammogram in an asymptomatic 42 years old woman with extremely dense breast parenchyma (Figure 6 a, b). ABVS (Figure 6 c, d, e) shows an hinomogeneous hypoechoic area on the inferior-outer quadrant of the left breast (U4a). Ultrasound core needle biopsy revealed an area of fibrocystic changes.
Images for this section:

**Fig. 1:** Invasive ductal carcinoma associated with ductal carcinoma in situ.

© - Udine/IT

**Fig. 2:** Mixed ductal-lobular carcinoma.

© - Udine/IT
**Fig. 3:** Invasive lobular carcinoma.

© - Udine/IT

**Fig. 4:** Fibrosis and usual ductal hyperplasia.

© - Udine/IT
**Fig. 5:** Fibrosis.

© - Udine/IT

**Fig. 6:** Fibrocystic changes.

© - Udine/IT
Conclusion

ABVS has the capability to detect small cancers not seen on standard mammography in women with dense breast.

Imaging features of breast malignancy frequently made more evident by ABVS are heterogeneous echo pattern, echogenic halo, irregular shape and not circumscribed margins.

As well as for HHUS [2], also for ABVS false positives are common findings. In the scenario of ABVS screening false positives could be reduced improving readers experience [8, 9].

Addition of ABVS to mammography in women with dense breasts can increase the number of cancers detected having a potential role in the screening setting as an adjunctive tool to mammography in dense breasts.
References