Diagnostic performance of automated breast volume scanner (ABVS) versus hand-held ultrasound (HHUS) as second look for breast lesions detected only on magnetic resonance imaging.

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Aims and objectives

Breast magnetic resonance imaging (MRI) has emerged as the most sensitive diagnostic technique in the diagnosis and evaluation of breast cancer. However, the reported specificity of MRI is relatively low, ranging from 40% to 80%. As a consequence, second look ultrasound is necessary for further evaluation in case of breast lesions detected by MR only. (1,2). Automated Breast Volume Scanner (ABVS) is a new technology with possible advantages over conventional hand-held ultrasound (HHUS) such as higher reproducibility and less operator dependence (3). Furthermore, ABVS innovative features include high-resolution volume data, availability of complete imaging for second-reading and acquisition of coronal plane images (4). We hypothesize that these features may be helpful for accurate correlation with MRI findings. However, limitations of ABVS are exclusion of axillary regions from the field of view and the absence of tools for vascularity and tissue elasticity analysis. To our knowledge only one study has been published regarding ABVS as a potential replacement of handheld second-look US (5). Our aim is to compare diagnostic performance of ABVS versus HHUS as a second-look tool for additional suspicious lesions detected on magnetic resonance imaging (MRI).
Methods and materials

This prospective study, performed over 2 months period, includes all patients showing additional BI-RADS®2 to 5 lesions on breast MRI who underwent both HHUS and ABVS as a second-look evaluation. We included also BI-RADS®MRI 2 lesions in order to test the new ABVS system.

MRI protocol

Breast MRI imaging studies were performed on a 1.5 T scanner (Magnetom Avanto, Siemens Medical Solutions, Erlangen, Germany). The dynamic contrast study was obtained using axial sequences as follows: diffusion-weighted echo-planar sequence, T2-weighted short time inversion recovery sequence and a non-fat-saturated T1-weighted spoiled gradient-echo sequence before and five times after intravenous contrast agent administration. Contrast material was gadobenate dimeglumine (MultiHance; Bracco Imaging, Milan, Italy), injected at a dose of 0.1 mmol/kg (0.2 ml/ kg), followed by a 20 ml saline flush.

Indications for MRI were evaluation of extent of disease in patients with breast cancer, high familiar risk of breast cancer, complex cases and suspicious nipple discharge.

HHUS second look

HHUS second look was performed using a 5-17 MHz linear array (iU22, Philips Medical Systems) or a 6-15 MHz linear array (Logiq E9, GE Healthcare) by one of five dedicated breast radiologists (experience with breast imaging from 6 to 20 years). HHUS was focused on MRI findings using MR images as a guide to identify additional lesions.

ABVS second look

ABVS second look was performed using Acuson S2000 ABVS (Siemens Medical Solutions, Mountain View, CA, USA). The system is equipped with a linear transducer (Siemens 14L5BV, 5-14 MHz). This ultrasound probe covers a distance of 16.8 cm in approximately one minute. A typical exam consists of three automated scans of the interested breast (anterior-posterior position and both the oblique positions; occasional additional views were required for larger breasts). After volume data acquisition, the data were automatically sent from the automated breast volume scanner to the workstation and reviewed in multiple orientations in transverse, coronal, or sagittal planes.

Image analysis
Two radiologists (experience with breast imaging of more than 2 years) in consensus reviewed HHUS and ABVS images attributing BI-RADS®1-2 or BI-RADS®3-5 to all the additional findings, according to the BI-RADS lexicon for US. For each lesion, the final BI-RADS assessments was provided as follow: 1: negative; 2: benign; 3: probably benign; 4A: low suspicion; 4B: intermediate suspicion; 4C: moderate suspicion; 5: highly suggestive of malignancy (6).

Statistic analysis

Agreement for detectability and BI-RADS® classification was assessed using Cohen’s Kappa statistic.
Results

Final population included 60 women with 65 only MRI detected lesions.

Of those, 12 had not ABVS correlation and 11 lesions had not HHUS correlation. Fifty-three lesions (81%) were identified on ABVS and 54 (83%) on HHUS. Twenty-six lesions were assessed as BI-RADS®US 2 on both ABVS and HHUS. BI-RADS®US 3-5 included 27 ABVS lesions and 28 HHUS lesions.

Two lesions were not recognized on ABVS: one (BI-RADS®MRI 3) was classified as BI-RADS®3 on HHUS and resulted to be an intraductal papilloma. The other lesion (BI-RADS®MRI 5), detected in a patient with known breast cancer, was assessed as BI-RADS®5 on HHUS and proved to be an additional neoplastic focus. The lesion (BI-RADS®MRI 4) missed by HHUS was assessed as BI-RADS® 4 on ABVS, and resulted to be a DCIS.

Agreement was "very good" for detection: K=0,90 (95% CI: 0.801-1.000) and "good" for BI-RADS assessment: K= 0,75 (95% CI: 0.634 to 0.879) with no relevant shifts.
Fig. 1: Sixty-two years old woman with biopsy-diagnosed invasive ductal carcinoma of the right breast. Dynamic contrast-enhanced MRI (A,B) revealed a small suspicious enhanced mass (yellow arrow) posteriorly to the main lesion (red arrow). Hand-held second-look ultrasound (D) revealed an irregular shaped hypoechoic mass with indistinct margins that was confirmed with the same features on ABVS second-look (C: transverse plane, E: coronal plane, F: sagittal plane) and classified as BI-RADS®US 5. Ultrasound-guided core needle biopsy revealed an additional neoplastic focus.

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Fig. 2: Fifty-eight years old woman with biopsy-diagnosed invasive ductal carcinoma of the right breast. Dynamic contrast-enhanced MRI revealed a small suspicious enhanced mass between inner quadrants of the left breast (A). Hand-held second-look ultrasound revealed an hypoechoic mass with mainly circumscribed margins (B) confirmed with the same features on ABVS second-look (C: transverse plane, D: coronal plane, E: sagittal plane) and classified as BI-RADS®US 3. Ultrasound-guided core needle biopsy revealed a benign lesion (fibrocystic changes; B2).

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Fig. 3: Seventy-four years old woman with biopsy-diagnosed invasive ductal carcinoma in the upper-outer quadrant of the right breast. Dynamic contrast-enhanced MRI revealed a small suspicious enhanced mass with the wash-out pattern in the right breast, which was located in the same quadrant as the main mass (A). Hand-held second-look ultrasound revealed an irregularly shaped hypoechoic mass with indistinct margins (B). ABVS revealed a small hypoechoic mass with same features (C: transverse plane, D: coronal plane, E: sagittal plane). Ultrasound-guided core needle biopsy revealed an additional neoplastic focus.

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Conclusion

ABVS is comparable in terms of detection and BI-RADS assessment to HHUS as a second-look tool. Since ABVS has the advantage of high reproducibility it might be considered as a potentially second-look evaluation tool.
References


