The characteristics of 3D automated breast ultrasound (ABUS) detected cancers in a service screening mammography program

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Authors: B. Wilczek, M. Janicijevic, K. Thorneman, K. Hågemo, B. Adalsteinsson, C. Hinzer, K. S. Leifland; Stockholm/SE
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Purpose

Mammographic screening has a well-known reduced sensitivity for dense breast parenchyma[1].

Automated Breast 3D Ultrasound (ABUS) is a promising new technology[2-3]. Its future roll and indications need to be evaluated. It has been suggested as a complement to mammography in screening for breast cancer in dense breasts[4-10]. Our study had for aim to determinate its impact in combination with full field digital mammography (FFDM) in asymptomatic women with dense breasts in a Swedish service screening program and to describe the characteristics of malignant breast tumors detected by ABUS in combination with full field digital mammography (FFDM) and ABUS only.

Methods and Materials

Between Nov 2010 and February 2012 after informed consent 1676 asymptomatic women aged 40-74 presenting with more than 50% density in the breasts at visual evaluation by the radiographer were enrolled in the European Asymptomatic Screening Study (Easy Study)

Pregnant or lactating women, women who had breast surgery less than one year ago or women treated with radiation or chemotherapy within one year prior to screening were excluded.

ABUS was obtained and reviewed in combination with double read 2 views FFDM.

The bilateral ABUS examinations were performed by a radiographer who gently compressed the breast with a paddle casing including a 14-6 probe. ABUS presented tissue capture from skin to chest wall. Frontal, lateral and medial projections 3D volumes were displayed in 2 mm slices for fast review. Fig. 1 on page 3 The slice thickness has been chosen to match the average size of an individual terminal ductal lobular unit (TDLU) from which most breast cancers originate[10]

The image assessment was performed by a radiologist who was the first FFDM screening reader. All ABUS examinations were doubled read by the second reader, if the FFDM findings by either reader, or ABUS findings by the first reader, led to discussion among the two readers.

ABUS and mammography images interpretation time was around 7 minutes per examination.
All abnormalities were appropriately worked up with complementary mammographic images and handheld ultrasound whether they were seen on the screening mammography images or ABUS. The recall rate was 2.3%.

Images for this section:

**Fig. 1:** ABUS examination of the breast with pictures in the coronal plane.
Results

Eleven of the 1676 women were diagnosed with breast cancer when adding ABUS to mammography (0.7%). An increase of 57% compared to FFDM alone 2010.

The median age of these 11 women was 56 years and the mean age 53 years. Five women belonged to the age group 40-49.

Invasive cancer was found in 10 of these cases, 9 invasive ductal cancers and 1 invasive lobular cancer at core needle biopsy that in the specimen PAD after surgery proved to be an invasive ductal cancer. This case was normal on FFDM but pathological (unifocal) on ABUS. Fig. 2 on page 5

The remaining case was diagnosed with ductal cancer in situ (DCIS) and lobular cancer in situ (LCIS) at FFDM only. The maximal diameter of this mixed malignant in situ lesion was 25mm at specimen PAD. Fig. 3 on page 5

ABUS and FFDM findings were concordant for 6 invasive tumours.

In one case a unifocal tumour, that was not detected on the screening FFDM images, became mammographically obvious as a distortion in fibrotic tissue when cone down images were obtained. The woman was recalled because the ABUS images showed pathological sign. The tumour was an invasive ductal cancer Elston Grade II located in fibrotic tissue and measuring 40X25mm. One micrometastasis was found in the sentinel node. At axillary dissection 14 nodes were extirpated and found normal.

Four of the eleven women had multifocal tumours; two of them were recalled because of both FFDM and ABUS. Complementary diagnostic mammography and handheld ultrasound confirmed the suspicion.

The third one was also recalled because of the FFDM images and ABUS but complementary diagnostic mammography images freed the woman. ABUS showed 4 invasive cancers in the ipsilateral breast that were confirmed by handheld ultrasound. The specimen PAD after surgery showed 7 foci of invasive ductal cancers Elston Grade II close to each other and adjacent DCIS Elston Grade I-II. The invasive part was 44X33mm and in combination with the surrounding DCIS the area was 57X40mm. The sentinel node was normal. The patient underwent a large partial mastectomy.

The fourth patient in this group that was diagnosed with multifocal tumours had normal FFDM images (screening and complementary) but lesions were seen on the ABUS images and confirmed by handheld ultrasound. Two invasive ductal tumours, 32 mm and 14 mm respectively, were diagnosed and extirpated. Both cancers were Elston Grade I with a normal sentinel node.
The remaining two cases that were normal at the FFDM images but pathological at the ABUS examination were invasive cancer, one tubuloductal Elston Grade I that measured 13x10mm and presenting also DCIS Elston Grade I and metastasis in one of 6 axillary lymph nodes and the other one was a 20 mm invasive ductal Elston grad III with normal sentinel node.

In all invasive cancer cases the tumours were Estroge and Progesterone positive and in 9 cases out of 10: Herneu2 negative.

The two cases with DCIS Fig. 3 on page 5 Fig. 4 on page 6 were occult on ABUS but seen as clustered microcalcifications on the mammography images.

One of these two patients had a contralateral invasive cancer seen at both procedures. This was the case that was Herneu 2 positive Fig. 4 on page 6 Fig. 5 on page 7

**Images for this section:**

**Fig. 2:** Invasive ductal cancer Elston grade III. Sentinel node negative. Seen on ABUS, not on mammo. Confirmed by hand-held ultrasound.
Fig. 3: DCIS grade II with necrosis and lobular in situ cancer. Seen on mammo, not on ABUS.
Fig. 4: Contralateral DCIS grade II with necrosis. Seen on mammo, not on ABUS (left breast).
Fig. 5: Ductal invasive cancer grade II + DCIS. Sentinel node negative. Seen on mammo/ABUS (right breast). Contralateral DCIS grade II with necrosis (left breast).
Conclusion

ABUS in combination with mammography increased the detection rate of invasive breast cancer but did not detect the DCIS that presented as clustered microcalcifications.

Further studies are needed in order to establish when ABUS could be used.

References


Personal Information