

4D Ultrasound Case Reports - Can Ultrasound Studies Of Breast Masses be Standardized Based On Established Criteria?

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Introduction

Breast cancer is the most common malignancy worldwide. According to the International Association of Research on Cancer (IARC) the annual incidence is at one million women, carrying with it a mortality of 410,000 p.a. With the advent of screening programs mortality dropped by up to 20% (Ries LAG et al. Seer Cancer Statistics Review, 1975-2002). In addition to inspection and palpation early detection may also involve a variety of standard diagnostic modalities such as ultrasonography, mammography and nuclear magnetic resonance tomography. According to the S3 guidelines screening the breast by ultrasonography is a diagnostic complement to mammography whenever suspect masses are involved. Ultrasound studies of breast lesions are of particular importance in young women, in pregnancy and breast feeding, and in high risk patients 30 years and younger.

Research efforts focused on improving image quality and on the sonographic visualization of three-dimensional structures. During the last 30 years technologies were developed to depict organ structures in three-dimensional space by

computing the “third dimension” from two slice planes. Early multiplanar scanners were moved along the structure to be studied within a defined time period and with a defined scan length. From the data thus generated a volume data set was computed. In the 1990s this technique was improved by the so-called rendering mode. At the same time transducer technology was further developed and control of the ultrasound beam is based now on electronic rather than mechanical means (motion-sensing system). To date, very few papers have compared volume ultrasonography with conventional 2D ultrasound studies with regard to the assessment of possible malignancy of breast masses. Initial results did not yield a definite advantage of one modality over the other in terms of sensitivity (92 % 2D versus 97 % 3D) and specificity (81 % 2D versus 72 % 3D). However, since a complete 3D data set can be stored, postprocessing permits reconstruction of any slice plane which allowed a standardized modality based on altogether new criteria for malignancy (Fischer T et al. RöFo 2006;178:1224-1234). In the case reports below, 4D ultrasonography, a

new diagnostic volume study with temporal resolution, was used to differentiate between benign and malignant masses and correlated with the histopathology. The application of this modality for depicting the coronary planes and the standardized assessment of the edge of the tumor with the “multi-view” option are described.

Case Report

Two women presented to our multidisciplinary breast center for ultrasound-guided biopsy. The diagnosis on referral was based on suspect findings on palpation in one case and in the second case on a suspect finding on mammography. The first patient was a 64-year-old woman with an unremarkable family history and a newly found mass on mammography. Initially no definite mass could be defined on palpation. Selective high-resolution sonography (Aplio XG, Toshiba, 9 MHz, THI, FC) revealed a hypoechoic change in tissue texture in the right upper outer quadrant with a diameter of 10 mm and posterior shadowing. Due to the lipomatous involution of the breast the edge of the tumor was rather difficult to define from the surrounding

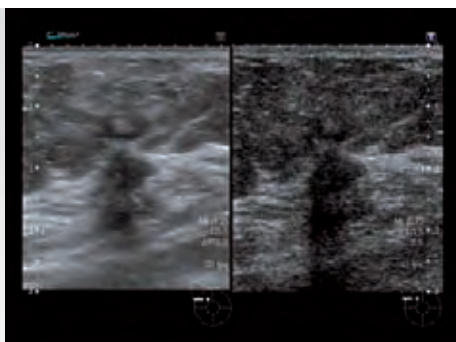


Fig. 1a: Hypoechoic mass with vertical alignment and posterior shadowing.

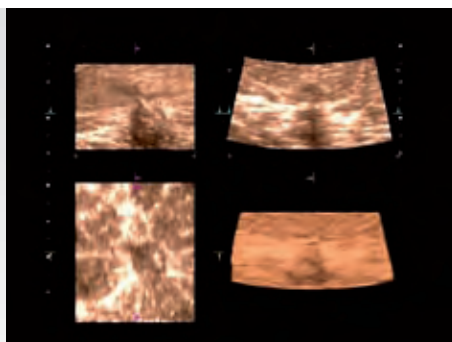


Fig. 1b: Definite changes in the structural texture and irregularly defined contour of the suspect mass.



Fig. 1c: Characteristic retraction phenomenon in the coronary plane of this small suspect lesion.

tissue. Other criteria included differences in the structural texture between both breasts and possible spiculation of the mass (fig. 1a). In the coronary plane 4D ultrasonography (Toshiba, Aplio XG, Otawara, Japan) demonstrated a retraction phenomenon which is characteristic for invasive ductal breast cancer (fig. 1b, c). This modality was used in real-time, permitting not only standardized visualization of the mass in any plane but also real-time assessment of the edge contour. The mass was classified as BIRADS category 5 and confirmed as invasive ductal breast cancer; the patient underwent breast-sparing surgery (fig. 1d). The second patient presented with a plum-sized mass suspect on palpation which on high resolution ultrasonography correlated with an ovoid, smoothly defined hypoechoic lesion with a delicate capsule (figure 2A). 4D ultrasonography demonstrated the well defined contour of the mass and especially the macrolobulation of the lesion (fig. 2b). The finding was easily defined from the surrounding tissue in

all planes and the structural texture remained unaltered (fig. 2c). Because of a family history of breast cancer the lesion was biopsied despite having been classified as BIRADS category 3. Histopathology confirmed the diagnosis of a fibroadenoma (fig. 2d). Adhering to the wishes of the patient the fibroadenoma was resected.

Discussion

Epidemiologically speaking the incidence of breast cancer is increasing, accompanied by an ever earlier premenopausal presentation of the malignancy. Ultrasonography is the diagnostic modality of choice to assess possible malignancy of a suspect finding in young women, in patients with a family history of breast cancer and in women with dense parenchyma of the breast. Since ultrasonography plays an increasingly important role in the diagnostic assessment of the breast it must offer high sensitivity and specificity for safe differentiation between benign and malignant masses.

Although 3D ultrasonography of the breast has been available for years, the few publications comparing 3D with the standard 2D image do not indicate any benefit regarding detection and assessment of possible malignancy of a mass. The diagnostic value of 4D diagnostic imaging of breast cancer can be compared with that of 2D imaging. The easy to use real-time 4D imaging modality with its high image quality offers a further improvement in volume ultrasonography. Especially additional criteria in the frontal plane yield important findings for typing masses.

Practical Conclusion

- 4D ultrasonography of the breast depicts edge contour and retraction in detail and standardized fashion: benefit compared with 2D ultrasonography.
- Further studies are required on the diagnostic value of 4D ultrasonography of the breast.
- For the time being mammography remains the diagnostic modality of choice.

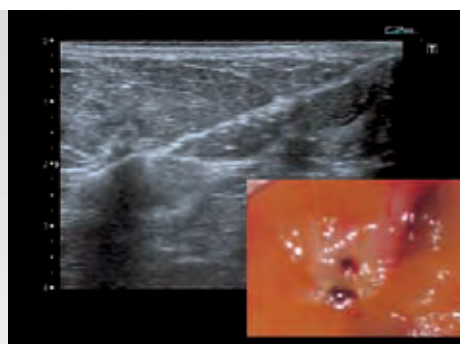


Fig. 1d: Confirmation of the mass by core needle biopsy and correlation with the surgical specimen where the canal of the core needle biopsy passes through the center of the lesion; in addition, this invasive ductal breast cancer also displays spiculation.

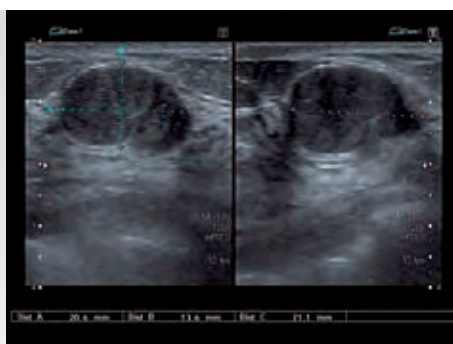


Fig. 2a: Smoothly defined mass with delicate capsule and posterior enhancement.

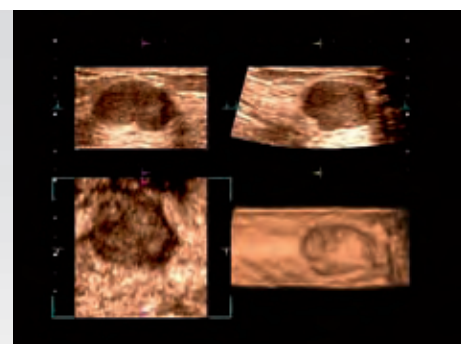


Fig. 2b: Smoothly defined macrolobulated mass.

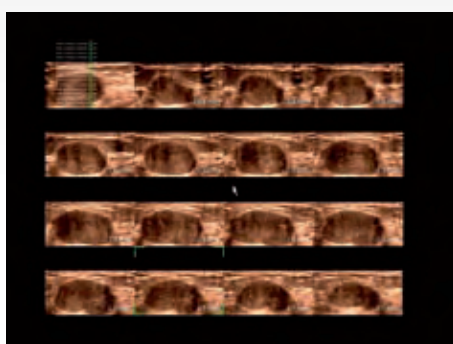


Fig. 2c: In the coronary plane as well the mass is smoothly defined and macrolobulated.

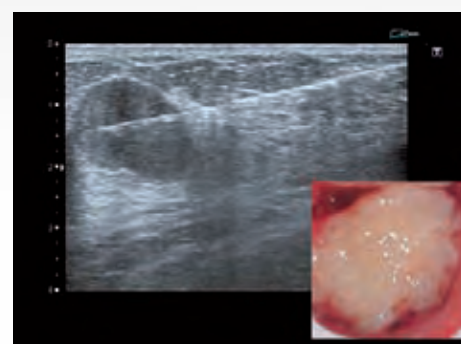


Fig. 2d: Documented position of the needle tip inside the mass and good correlation with the surgical specimen of a fibroadenoma.

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