Case Report

Microcalcification Detection in Breast Ultrasound – A New Perspective?

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Introduction

The prime task of diagnostic breast ultrasound is the focused rapid assessment of new findings on palpation, particularly in young women with dense mammary tissue. Optimization of the devices for this modality has resulted in high-resolution breast ultrasound which over the last few years has led to marked improvements in image quality, detail recognition and spatial resolution of the sonographic image. Techniques such as Tissue Harmonic Imaging (THI) and Spatial/Frequency Compounding (FC) have made it possible to visualize even the smallest changes in tissue (Thomas A et al. Ultraschall in Med 2007; 28:387-393). The precursors of breast cancer, such as the ductal carcinoma in situ (DCIS), are increasingly moving into the center of attention. DCIS is characterized by attenuation of the echo akin to that of fat, primarily horizontal spread and dilated arborescent mammary ducts with changes in gland substrate and architecture. Usually, the typical criteria of malignancy such as posterior acoustic shadowing, spiculation and echogenic halo can not be visualized in these masses (Hille H et al. Ultraschall in Med 2007; 28(3):307-12). Another characeristic finding are so-called hyperechoic spots. They may indicate microcalcification as well as detritus and are considered a further criterion of malignancy (Fischert T et al. RöFo 2006;178:1224-1234).

In the case presented here, for the first time a new ultrasound technique (MicroPure™ by Toshiba, Otawara, Japan) to reliably differentiate microcalcification was employed and correlated with mammography. The report below describes the specific application of this technique in locating the calcifications and performing the ultrasound-guided high-speed core needle biopsy.

Fig. 1: Hypoechoic textural change with horizontal orientation lacking posterior shadowing and with possible hyperechoic spots on B-mode imaging (9 MHz, THI, spatial and frequency compounding)

Case report

A 48-year-old women presented in our specialized core needle biopsy clinic with a newly found mass. At this time there were no results of previous studies and her family history was negative. Initial palpation revealed a solid micronodular finding in the right inferior lateral quadrant. Selective high-resolution sonography (Aplio XG, Toshiba, 9 MHz, THI, FC) revealed a hypoechoic change in tissue texture with a diameter of 17 mm and horizontal orientation. Other characteristics were neutral acoustic properties of the posterior ultrasound echo, relationship with the dilated hypoechoic ductal system, asymmetric changes in the tissue texture and possible hyperechoic spots along the ductal system (Fig. 1).

Visualizing the microcalcifications was improved significantly by a novel software-based ultrasound functionality called MicroPure™ (Aplio XG, Toshiba, Otawara, Japan). The technique is based on visualizing hyperechoic microcalcifications beyond a certain threshold. The results of this study were superimposed in color (level 4 on a four-level purple color mask) on the B-mode image (Fig. 2). It was also possible to apply this technique in real-time and extensive inferior and superior microcalcification clusters were revealed in the lateral quadrant which had escaped detection in the B-mode study. Subsequent to this ultrasound study magnified mammography confirmed extensive microcalcifications and correlated with the findings (Fig. 3).

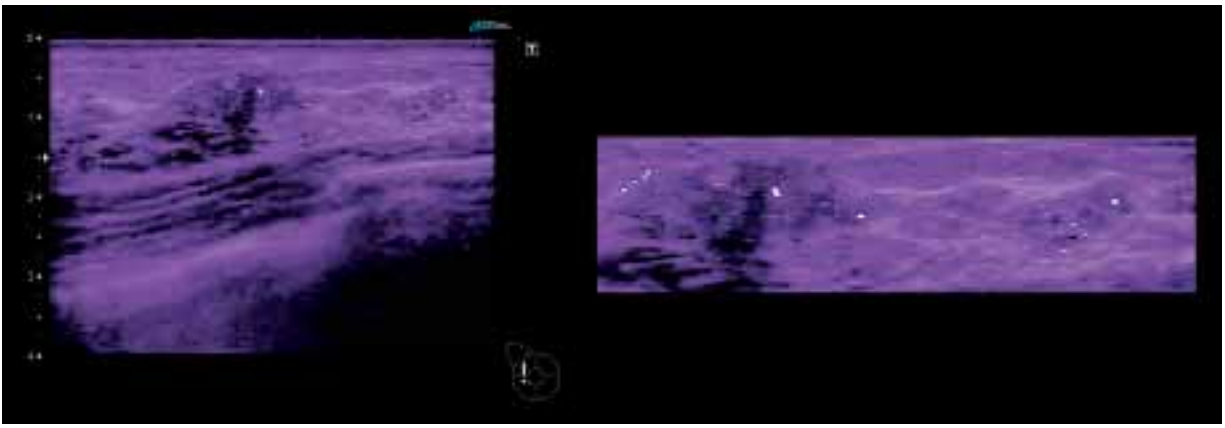

Fig. 2: Demonstration of the same area with color mask and magnified section. The microcalcification extending along the hypoechoic filled ductal system is visualized particularly well (8 MHz, MicroPure™, THI).

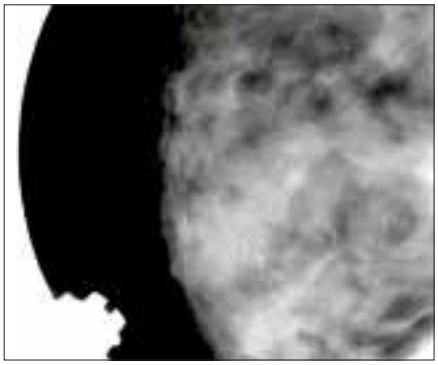

Fig. 3: Magnified mammogram of the lateral quadrant. The image demonstrates multiple microcalcification suspected of malignancy. Due to the dense gland tissue no additional masses can be identified.

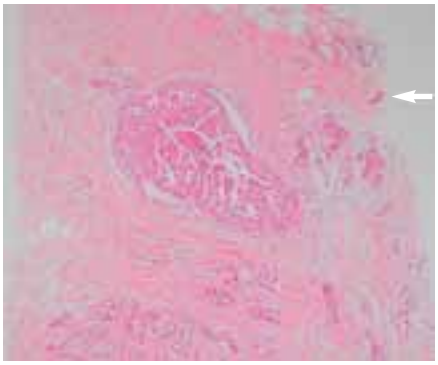

Fig. 4: Pathology section (HE stain, magnification 50x) of the ultrasound guided core needle biopsy with demonstration of an invasive ductal element (#) and calcification at the rim (white arrow).

In a next step ultrasound-guided core needle biopsy of the hypoechoic change in texture (mammography was unable to visualize the finding because of the dense gland tissue) and the adjacent microcalcifications was performed employing MicroPure™. Pathological workup revealed invasive ductal breast cancer with extensive high-grade DCIS in the surrounding tissue (Fig. 4). As part of the surgical workup a preoperative MRI study was performed which also confirmed extensive DCIS, transgressing the quadrant, with an invasive element and normal findings in the contrallateral breast. As part of her treatment the patient underwent mastectomy of her right breast.

Discussion

In the last decade continuous advances in ultrasound technology with concomittant improvements in image quality and resolution of detail revolutionzed sonography. In addition to improved device technology software programs were developed which made it possible to highlight fine structures, such as microcalcification, by means of special raw data filters. In the context of this case study MicroPure™ was used for the first time to sonographically detect an extensive DCIS with an invasive element and to verify it histologically. As reported by various studies diagnosis was guided primarily by the distribution of the microcalcification and by the asymmetric hypoechoic finding of textural changes involving the ductal system (Kang SS et al. Euro J Radiol 2008; 67(2):285-291). In addition to high-resolution ultrasound workup research (Londero V et al. Radiol med 2007; 112(6): 863-76) strongly suggests that the presence of extensive (>2 cm) hypoechoic textural changes is indicative of an invasive element. Where calcification correlated with textural changes, subsequent workup quite often revealed a DCIS, while the lack of sonographic correlation frequently coincided with benign calcification.

In summary, since with regard to the question at hand current data is insufficient for a final assessment of the value of ultrasound, mammography, particularly digital mammography, remains the modality of choice in the workup of ambiguous microcalcification.

If a defined area of calcification is present and the mammogram finding is known, ultrasound-guided targeted needle biopsy of the calcification may also be performed. As this case report demonstrated, textural change, microcalcifications and palpation findings were diagnosed rapidly and efficiently.

Once this method has been validated by extensive studies, we believe it to have the potential to go beyond the 'interesting case' level and to be applied specifically in certain diagnostic situations.

Practical conclusion

- Current data on the general sonographic study of microcalcification is unsatisfactory.
- The new ultrasound technology MicroPure™ can visualize microcalcification and invasive elements in detail and offers benefits compared to B-mode ultrasound.
- For the time being, mammography remains the modality of choice in the workup of microcalcification.

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