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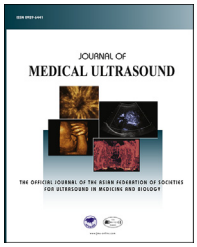

REVIEW ARTICLE

The Role of Breast Ultrasound in Early Cancer Detection

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Abstract Ultrasonography (US) is currently considered the first-line examination in the detection and characterization of breast lesions including the evaluation of breast cancer. Yet only few single-center cohort studies analyzing breast US in the framework of screening could be identified. In spite of mammography consider as the primary method for screening especially the noteworthy ability of microcalcifications detection. US is good in mass or mass-like lesion detection, especially in the dense breast population that proved by the study of ACRIN 6666. A lobular hypoechoic area; lesion with ductal extension and dilatation; and a hypoechoic nodular lesion with a dilated lactiferous duct leading to the retroareolar region, that were the common ultrasound findings in Ductal carcinoma in situ (DCIS) and probably related to nuclear grade of cancer. Computer programs have been developed and approved for use in clinical practice, the application including CAD (computer aided/assisted detection/diagnosis), ABUS (automated breast US), elastography and microbubbles in contrast-enhanced ultrasound. Furthermore the standardized scanning; improving with computer technology implementation and familiar to the picture of DCIS is necessary for progress the competence of early breast cancer detection.

Since improved screening methods for breast cancer and more effective biologic-based tailored systemic therapies have been accomplished, mortality [1] and the extent of surgery necessary for local and systemic control of disease is decreasing [2]. Mammography has been established as the primary method for screening. Some 35–45% of non-palpable cancers are detected as microcalcifications in mammographic studies [3]. These microcalcifications can sometimes be visualized by modern ultrasound (US) equipment, but cannot be reliably identified as such without knowledge of mammography [4,5]. Nothacker et al

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reviewed [6] a few single-center cohort studies analyzing breast US in the framework of breast cancer screening. Screening for breast cancer focuses on detecting occult cancer at an early stage with tumor size preferably < 1 cm, negative lymph node status, and with no evidence of distant spread. Ductal carcinoma *in situ* (DCIS) is a noninvasive form of breast cancer comprised of a heterogeneous group of lesions with diverse malignant potential. US is currently considered the first-line examination in the detection and characterization of breast lesions including the evaluation of breast cancer. It is generally acknowledged to be a highly operator-dependent modality that requires a skilled practitioner and state-of-the-art equipment. The influencing factors include interobserver variability and intraobserver variability. Actually, for small and nonspecific lesions, US is blamed for too many false-positive lesions that may require short-term follow-up or US-guided biopsy [7,8]. The biopsy rates in the evaluated studies of 2.3—4.7% were significantly higher than the biopsy rates of about 1—2% resulting from mammographic screenings [9]. Therefore, the use of US in screening just focus on special situations, such as for high-risk women with dense breasts [10] or used as a supplemental tool to assessment Breast Imaging Reporting and Data System category 0 in mammography screening with mass [11] or asymmetry findings. The success of supplementary screening US might be attributed to the low cancer detection rate of conventional mammography in the dense breast population. Women with dense breasts run a four- to six-fold higher risk of developing breast cancer than other women [12]. The inherent limitations of mammography conceal sonographically obvious cancers; by contrast, US is less sensitive to find mammographically detected DCIS or early cancer. Multimodality approach suggests that the more accurate the cancer size measurement, the more accurate the assessment of the distribution of the tumor [13]. However, for screening, US is increasingly used to detect early breast cancer worldwide. According to a multicenter trial of combined screening with mammography and US (ACRIN 6666) [14] that reported higher cancer detection in high-risk women who underwent annual ultrasound screening in addition to mammography compared to those that underwent mammography alone, the combined screening detected an additional 4.2 cancers per 1000 women [15]. The only US-detected cancers were mostly node-negative invasive cancers, with a median size of 10—13 mm [16,17]. The high-prevalence of US-only detected cancers and tolerance of US scanning in women makes US screening implementation possible. Furthermore, the standardized scanning and interpretive criteria proved to be practicable for independent performance and interpretation and could be used for further implementation.

Diagnostic breast US

Breast cancer in women younger than 40 years is rare and typically presents symptomatically. For symptomatic women, US is the primary modality for the evaluation of palpable masses in younger women. Palpable mass is not equal to advanced cancer and DCIS may present as a palpable mass. In pathologic nipple discharge, for detection of intraductal mass or hypoechoic irregularly subareolar mass, and differentiating between intraductal papillomas and carcinoma *in situ* and invasive cancer ultrasound, US is a useful diagnostic tool superior to mammography and may be worth including in the routine evaluation [18]. DCIS now accounts for as much as 30% of breast cancers in the general screening population and approximately 5% of breast carcinomas in symptomatic women. Breast Imaging Reporting and Data System criteria are not sufficient for discriminating between malignant and benign lesions. Subcategories 4A, 4B, and 4C are useful in predicting the likelihood of malignancy, yet are more difficult for smaller lesions [19]. In fact, DCIS is a tumor growth along the preexisting framework of breast ducts, instead of conspicuous breaking of the basement membrane. The malignant transformation including volume and distribution that may be terminal (targeting distant terminal ductal—lobular units), segmental (targeting a segment) or lobar (targeting the entire lobe) within the sick lobe [20]. Familiarity with the picture of DCIS is necessary for progress the competence of early breast cancer detection. In the literature, a

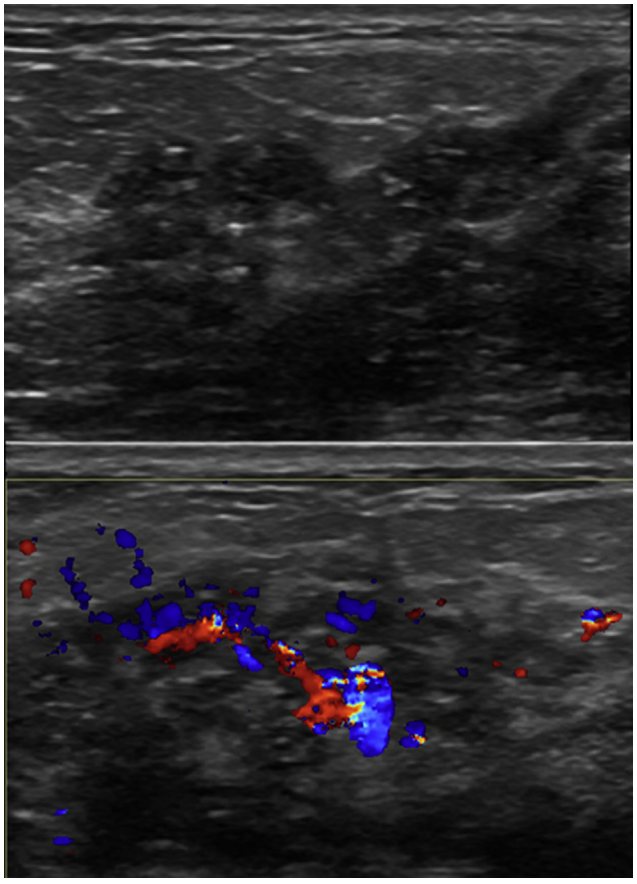

Figure 1 A lesion that presented as a wind duct dilatation with inhomogeneous hypoechoic tumor growth along the preexisting framework of breast ducts. The appearance resembles a branching stony coral. Color Doppler ultrasound revealed hypervascularity in the tumor. Pathology proved a high-grade ductal carcinoma *in situ* with multiple intraductal microcalcifications.

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