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ABSTRACT BOOK

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EJC SUPPLEMENTS

International Breast Ultrasound School workshop

E5. Breast ultrasound – update

Alexander Mundinger[a,*], A.R.M. Wilson[b], C. Weismann[c], H. Madjar[d], W. Heindel[e], E. Durante[f]

[a] Niels-Stensen-Clinics, Breast Centre Osnabrück, Franziskus-Hospital, Georgsmarienhütte and Radiological Department, Marienhospital, Osnabrück, Germany
[b] Department of Radiology, Royal Marsden Hospital, London, UK
[c] Abteilung für Mammadiagnostik und Mammaintervention am Universitäts Institut für Radiologie, LKH-Salzburg, Salzburg, Austria
[d] Brustzentrum, Deutsche Klinik für Diagnostik Wiesbaden, Wiesbaden, Germany
[e] Universitätsklinikum Münster, Institut für Klinische Radiologie und Röntgendiagnostik, Münster, Germany
[f] Department of General Surgery II, University of Ferrara, Ferrara, Italy

Abstract

The advances made in recent years in high frequency ultrasound (US) transducer technology using broad bandwidth and high-dynamic range technology have led to considerable improvements in two-dimensional (2D) and three-dimensional (3D) greyscale diagnostic imaging of the breast. The role of elastography, focusing on the differentiation between benign and malignant lesions, continues to be evaluated. US is the method of choice to assess and sample, with core biopsy, most breast abnormalities, while stereotactical guided vacuum assisted biopsy (VAB) is the method of choice to sample screen-detected microcalcifications and architectural distortions not seen on US. In the dense breast, the addition of US to screening mammography improves the sensitivity for cancer considerably. The mean supplemental diagnostic yield of US after negative mammography is 3.2 per 1000 women with dense breasts. US is the first line imaging technique for symptomatic breast patients and women under the age of 40. The International Breast Ultrasound School (IBUS) and Breast Imaging-Reporting and Data System (BI-RADS) breast US guidelines have introduced some consistency to examination technique and reporting. Intraoperative surgeon-performed ultrasound focuses on the accurate definition of the resection segment or sector and the margin analysis of the resection specimen. US-guided VAB is being used increasingly for diagnosis of borderline lesions, to complete preoperative staging in patients with extensive ductal component and for therapeutic excision. Magnetic resonance imaging (MRI) is useful preoperatively to assess the extent of ipsilateral disease and to exclude the contralateral breast cancer, particularly for women at increased risk of mammographically occult disease.

International Breast Ultrasound School (IBUS)

IBUS was founded December 1991 as a non-profit organisation and has become the leading international provider for teaching all aspects of breast ultrasound (US) delivered through international training centres in Ferrara (Italy), Athens (Greece), Muenster (Germany), Zurich (Switzerland), Salzburg (Austria), São Paulo (Brazil) and by collaboration with international congresses. [1]

Basics and new horizons of US technology

Modern technology includes 2D, 3D and 4D US featuring spatial and frequency compounding, tissue harmonic imaging and speckle reduction techniques that reduce noise and increase contrast resolution. [2] The indications for techniques that measure the elastic properties of tissue (elastography) are being evaluated with the focus on the differentiation between benign and malignant lesions. Shear wave elastography involves acquisition frame rates of at least 5000 Hz and this technology is likely to prove to be an effective additional US technique. [3] New horizons in high-end US technology include miniaturised and portable US systems and automated whole breast US.

Update of examination, imaging indications and ACR BI-RADS® -US

IBUS and ACR breast US guidelines are designed to give consistency to examination technique and reporting. [4,5] New diagnostic descriptors focussing on elastographic, 3D tissue criteria, vascularisation and lymph node morphology will probably be considered for an update of the BI-RADS®-US version. [6] While actual ACR guidelines exclude palpable lesions from BI-RADS-Mammography 3 category, [7] recent studies and US guidelines consider follow-up of solid, non-palpable masses with benign US features (BI-RADS® -US 3, probably benign) as an acceptable alternative to biopsy in the light of a negative predictive value of up to 99.8%. [8,9] The mean supplemental diagnostic yield of US after negative mammography is 3.2 per 1000 women with dense

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Table 1 Summary of advanced indications for high resolution ultrasound

Differentiation between cysts and solid tumours
Differentiation between benign and malignant
Characterisation of palpable abnormalities
Characterisation of mammographic densities
Lesion size, multifocality and surrounding tissue, intraductal extension, skin and nipple distance for planning breast conservation, mastectomy or reconstruction with implants
Improved sensitivity in young women, during pregnancy or lactation
Women with benign disease
Under hormonal replacement therapy
With inflammation and abscesses
After surgery and radiation
Silicone implants
Guidance of interventional procedures, such as fine needle aspiration, core biopsy or diagnostic and therapeutic vacuum biopsy and preoperative tumour localisation
Preoperative follow up under neo-adjuvant chemotherapy
extended screening for young high risk patients

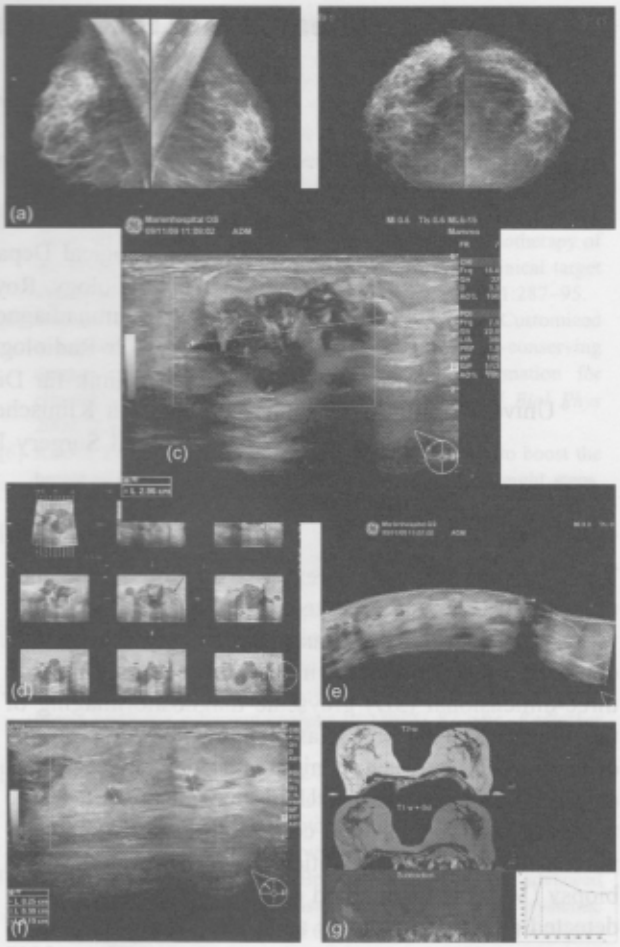
breasts.[10] US is the first-line method for symptomatic breast patients and women under the age of 40 (Table 1).

Role of assessment US in DCIS and small cancers – Experiences of mammography screening programmes

The German breast screening programme was in place nationally by the end of 2008 (11,12). The combined cancer detection rate is now 7.78 per 1000 women screened with DCIS representing 20.5 % of all cancers detected. Stage T1a and T1b represent 31.1% of all cancers while T1c is 47.2%. Seventy two percent of all patients presented with a UICC stage 0 or 1. These results are in line with the expected standard set in the European guidelines.[12] US is indicated for the further assessment of mammographic abnormalities and for guiding minimally invasive biopsy. US was the method of choice to assess and puncture masses, dilated ducts, pseudomicrocystic lesions and dense accumulations of high grade microcalcifications that corresponded with mammographic changes. Although the detection rate of DCIS by screening US is low, targeted US of suspected DCIS frequently does show abnormalities.[13]

Assessing the extent of primary breast cancer?

Mammographic size measurements are less accurate in lobular than ductal invasive carcinomas. However, mammography is superior to US and magnetic resonance imaging (MRI) in DCIS grade 1 (and 2) with calcifications. High-resolution US shows a comparable diagnostic performance in preoperative staging as MRI in invasive ductal cancer (Fig. 1). MRI performs better



Preoperative assessment of histological multifocal mass-forming and intraductal branching DCIS grade 2 including multiple invasive foci of ductal invasive cancer grade 2. High resolution US and MRI provide similar information concerning multifocal DCIS extension. (a) Newly developing mass of upper outer quadrant on mammography, mlo projection; (b) Corresponding mammography, cc projection; (c) Colour Doppler shows hypervascularisation of the mass; (d) Tomographic ultrasound presents intraductal extension of mass (arrow); (e) Panoramic view demonstrates multifocal expanded terminal ductal lobular units (TDLUs) extending from the duct system; (f) DCIS growing within expanded TDLUs; (g) MRI of the breast corresponds to ultrasound findings. Enhancing irregular mass and multifocal clumped non mass enhancement. Kinetic curve presents "washout" within the mass.

in the preoperative staging of lobular invasive cancer, DCIS, multifocality, multicentricity and posterior breast wall involvement as well as the diagnosis of recurrence and failing silicon prosthesis, and monitoring during neoadjuvant therapy. The median additional detection yield for MRI has been estimated as 16% in meta-analyses.[14] MRI is superior to other imaging in assessing the extent of ipsilateral disease and excluding contralateral breast cancer in patients with newly diagnosed breast cancer, particularly in women at increased risk of mammographically occult disease.[15] To date, there is no evidence that preoperative MRI improves surgical care or prognosis.[14]

Where do we stand in preoperative staging of axilla and breast?

Sentinel lymph node (SLN) biopsy is associated with a low local recurrence rate and similar survival to axillary lymph node dissection and is now the standard of care. However, all patients with invasive breast cancer should have US of the axilla to exclude obvious nodal local spread. The presence of asymmetric focal hypoechogenic cortical lobulations greater than 2 mm or a completely hypoechogenic node with US should prompt nodal fine-needle aspiration. [16,17] Sonographically guided biopsy has a sensitivity that varies between 30.6% (22.5–39.6%) and 62.9% (49.7–74.8%) and a specificity of 100% (94.8–100%). [18]

Evolving role of intraoperative imaging

The use of intraoperative US is useful for surgery involving segmental resection in malignant breast disease. Each of the 15 to 20 lobes of the breast is an independent sector or segment that can be assessed by intraoperative US with the goal to delineate even very small lesions. Surgical planning with US involves drawing on the skin the extent of resection, according to the lobar anatomy, and deciding on the most advantageous incision. Parameters used to plan surgery are the site of tumour, its dimensions, breast thickness, and the distances from the skin, fascia and nipple. Immediately, US of the excised tissue allows the surgeon to assess the completeness of excision by measuring the distances between the lesion and radial margins. [19] Preliminary studies suggest that surgeon-performed intraoperative US is a more cost-effective and practical procedure than mammographic needle localisation. [20]

Update and new developments in breast interventions

Modern breast care requires definitive non-operative diagnosis of all potential breast abnormalities in a timely and cost-effective way. [21] Fine needle aspiration (FNA) is ideal for lymph node sampling and cyst aspiration. [22] FNA of axillary lymph nodes can provide high specificity (89–100%) but varying sensitivity ranging from 54 % in T1 tumours to 100% for T4 tumours. [23] When the FNA finding is positive, SLN biopsy can be omitted and primary axillary lymph node dissection performed.

US-guided core needle biopsy (USCNB) has developed as the minimal invasive biopsy method of choice for all breast lesions (sensitivity 93% to 98 %; specificity ranges from 95% to 100 %). US-guided VAB is increasingly being used for diagnosis of borderline lesions, to complete preoperative staging in patients with extensive ductal component and for therapeutic excision of biopsy proven benign lesions such as fibroadenomas and some papillary lesions and radial scars. [24,25] The diagnostic accuracy of US-guided VAB is close to 100%.

Conflict of interest statement

None declared.

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