International Breast Ultrasound School workshop

E7. Where do we stand in advanced breast ultrasound?

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Advanced breast ultrasound (US) has reached new technological horizons that include miniaturised and portable US systems, optimised 3- and 4-dimensional US, automated whole-breast US, and hybrid systems combining different imaging modalities. High-frequency ultrasound reflects focal changes at the anatomic level of the terminal duct lobular unit and ducts. Multicentre studies have now shown that elastography can downstage Breast Imaging Reporting and Data System® (BI-RADS) 3 lesions. The International Breast Ultrasound School (IBUS) has set guidelines for examination techniques. The updated BI-RADS lexicon retains the important standardised analytical approach to lesion assessment, includes new technological and management concepts, and, in its 'Guidance' section, suggests methods for handheld and automated breast cancer screening. A new category of tissue elasticity is included for the first time. US guidance constitutes an evidence-based method to assess and harvest lesions in most breast abnormalities with the exception of minute microcalcifications and subtle mammographic architectural distortions not seen on US. US-guided vacuum-assisted biopsy (VAB) is a valuable tool for diagnosing borderline lesions and for optimising preoperative staging, and can be used for therapeutic excisions. In the dense breast, the addition of US to screening mammography improves the diagnostic yield of US after negative mammography by 3–4 per1000. Intraoperative surgeon-performed ultrasound focuses on the accurate assessment of the resection margin and surrounding tissue. In the near future breast ultrasound will translate technological advances to updated clinical and epidemiological concepts, including breast cancer screening using automated whole-breast ultrasound in high-risk situations.

Review and new perspectives of advanced ultrasound

High-frequency broadband transducers in combination with matrix technology improve spatial and contrast resolution. In the near future optimised extended matrix technology will enhance automated breast volume scanning [1]. Contour-finding algorithms and computer-aided diagnosis are already available and can help to detect and classify lesions by applying Breast Imaging Reporting and Data System® (BI-RADS) descriptors. Colour Doppler ultrasound (US) studies have been developed to include perfusion studies, presenting a mix of power and colour Doppler focusing on architectural vascularity patterns. Strain, shear wave and semi-static elastography add information about tissue stiffness [1–3]. Multicentre studies have shown that elastography can downstage BI-RADS 3 lesions [4].

New understanding of breast anatomy using high-resolution ultrasound

High-frequency US can now detect focal changes at the anatomic level of the terminal duct lobular unit and ducts [5]. US is also the first choice imaging modality for investigating the anatomy of the anterior compartment (skin, subcutaneous fat, Cooper's ligaments and superficial fascia) and the lymph nodes. An increasing number of guidelines now recommend radial scanning as part of the basic scanning technique.

What has changed in BI-RADS for ultrasound?

BI-RADS for ultrasound is predicated on excellent sonographic techniques, as specified in the International Breast Ultrasound School (IBUS) guidelines [6,7], and an understanding of breast anatomy. Disciplined feature

0959-8049/$ – see front matter

analysis for interpretation of ultrasound images, embodied in the lexicon of descriptors for important feature categories (shape, margin, and orientation taken together), underlies assessment of the likelihood of malignancy and facilitates evaluation of quality assurance and outcomes. BI-RADS for US is now used worldwide in recognition of US as a first-line breast imaging modality. The second edition, which includes many more example images, will be published in 2012 along with the 5th edition for mammography and 2nd for magnetic resonance imaging (MRI). The new edition incorporates new technological developments and management concepts, redefines some imaging descriptors, expands its coverage of calcifications and vascularity, and includes tissue elasticity among the associated findings. The forthcoming edition will include handheld and automated screening methods in its 'Guidance' section.

Interventional breast imaging

Automated core needle biopsy remains the technique of choice for the histological diagnosis of a breast lesion presenting as a mass. Fourteen-gauge core biopsy provides the information needed for informed treatment planning, including tumour type, histological grade, and receptor status. The false-negative rates range from 1.2 to 3.3% in studies with at least 2 years' follow-up [8]. For more difficult borderline lesions and for most lesions visible only on mammography or MRI vacuum-assisted biopsy (VAB) is the biopsy method of choice. VAB is significantly more likely to achieve a correct diagnosis for mammographic calcifications as it facilities retrieval of much larger volumes of tissue (up to 2 g). VAB should be used for all MRI-guided biopsies. VAB also offers the option for therapeutic excision of benign lesions or borderline lesions such as mucinous lesions, papillomas, and radial scars [9].

Where do we stand in axillary lymph node staging?

Sentinel lymph node (SLN) biopsy has become the recognised state-of-the-art technique for axillary staging in women with a focal small tumour associated with a clinically or US-negative axilla [10]. The indications for sentinel node biopsy have expanded to include women with ductal carcinoma in situ and a high risk of invasive cancer, and those with more advanced cancers. US-guided biopsy of abnormal axillary nodes is now established as a reliable method of avoiding sentinel lymph node biopsy and proceeding directly to axillary lymph node dissection (ALND) in those with malignant nodal disease. In a recent meta-analysis the mean sensitivity and specificity of preoperative US-guided biopsy was 79.6% and 98.3%, with a positive predictive value of 97.1% [11]. To date, selecting patients who may benefit from omitting ALND in low-risk axillary metastasis is subject to debate [12].

Intraoperative imaging: the new evolving concept

Intraoperative US of the excised tissue specimen allows accurate assessment of the resection margins [13]. Intraoperative breast US of the surrounding tissue should exclude residual foci using high-frequency equipment. The US-guided breast excision technique is predictable and accurate, minimises costs, and is advocated as an appropriate method for palpable lesions and US-only visible lesions [14]. Surgical ultrasound also promises future advantages in planning intraoperative radiotherapy.

Actual and future role of ultrasound: update

The actual role of breast US focuses on the further assessment and differentiation of mammographic lesions BI-RADS 0 and 3–5, palpable lesions, preoperative staging and planning for breast conservation or mastectomy, follow-up measurements of tumour response under neoadjuvant chemotherapy, guidance for interventional diagnosis, additional breast survey scanning in mammographically dense breasts (American College of Radiology [ACR] 3–4) and young women <40 years old, and in symptoms during pregnancy and lactation [9]. Based on pilot studies, Austria is planning the rollout of a nationwide mammography screening programme that includes ultrasound for women with dense breasts [15]. In future, technological advancements in breast US may transfer to breast cancer screening using automated whole-breast US in higher-risk situations [16].

Conflict of interest statement

None declared.

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