Breast evaluation with imaging methods

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Mammography, ultrasound and magnetic resonance imaging play a major role in detection, diagnosis and management of breast diseases. Besides these methods, other technologies have been considered for breast study, such as positron emission tomography (PET), spectroscopy, computed tomography, tomosynthesis and contrast-enhanced ultrasound. However, additional studies are necessary to determine the cost-benefit ratio of these methods.

Mammography still remains as the major breast imaging technique. It is the modality of choice for population breast cancer screening in asymptomatic women, and is the first imaging technique indicated for evaluating the majority of breast alterations. There is ample consensus that the mammographic screening reduces mortality from breast cancer in asymptomatic women[1,2]. Other benefits from the early detection include increase in the number of therapeutic options, in the probability of treatment success, and in the survival.

Presently, there are two modalities of imaging in terms of mammographic equipment. The first generation is constituted by the screen-film technique characterizing the conventional mammography. The second generation is represented by solid-state detectors defining the digital mammography. The technique of mammographic images acquisition (digital detector versus screen-film) defines the majority of differences between conventional and digital mammography. In the conventional mammography, the film is the media for recording, displaying and storing mammographic images, and, although generating high-spatial resolution images, this technique leaves very little room for improvements.

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In the digital mammography, the processes of images acquisition, display and storage are independent and may be individually improved; additionally, the analysis of digital mammographic images in workstations with high-resolution displays allows images processing for enhancing and improving visualization. The digital mammography also includes an array of new technologies like CAD (computer aided detection), tomosynthesis, use of intravenous contrast agents, and images interpretation at distance (teleradiolology).

Recently, Pisano et al.[3] have compared conventional and digital mammography in a study with 42,760 women, and concluded that the overall accuracy of the conventional and digital mammography for breast cancer screening was similar for both methods. However, the digital mammography has presented higher accuracy in some specific subgroups of women, namely: women aged less than 50 years, pre- and perimenopausal women with radiologically dense breasts. Notwithstanding, a great deal of debate has raised questions on the meaning and reasons for the higher accuracy of digital mammography in these subgroups. It is important to note that, currently, both the conventional and the digital mammography can be employed for population breast cancer screening. A consensus is still to be reached about the preferential use or conventional or digital mammography, even in specific subgroups of women.

The mammography capability to detect breast cancer varies among women according to some factors, and the most important one is the radiological breast density; the mammography sensitivity being lower in dense breasts than in those where adipous tissue predominates[4]. For this reason, supplementary imaging methods for dense breast screening and evaluation, particularly ultrasound and magnetic resonance imaging, have been studied.

Ultrasound is the main adjuvant method in conjunction with mammography and clinical examination

for detecting and diagnosing breast diseases[5], and has increasingly been used for years. Main indications and potential indications for breast ultrasound are: differentiation and characterization of solid nodules and cysts identified by mammography or clinical examination; guidance in interventional procedures; evaluation of young patients, pregnant and breastfeeding women with breasts alterations; investigation of mastitis abscesses; evaluation of palpable nodules in radiologically dense breasts; analysis of breast implants; locoregional staging of breast cancer; characterization of focal asymmetries which may correspond to nodules; evaluation of response to neo-adjuvant chemotherapy; and, as an adjuvant method, in the screening of breast cancer in women with radiologically dense breasts, aiming at identifying lesions missed by previous clinical examination and mammography. This latest indication is quite controversial and must not be utilized as an alternative to mammography, considering its limitations regarding detection and characterization of calcifications, architectural distortions and nodules localized in areas with predominance of adipous tissue. Ultrasound limitation for detecting microcalcifications is particularly relevant, since this is the most frequent finding in ductal carcinomas in situ.

Breast magnetic resonance imaging also has increasingly been used as an adjuvant method for characterization of malignant breast lesions and therapy planning. Many indications have been identified and evaluated, and usually are based principally on the high sensitivity of the method for detecting breast cancer, including lesions which have been missed by conventional methods (mammography and ultrasound). The use of magnetic resonance imaging has been investigated for the screening of women at high risk for breast cancer; screening of synchronous neoplasms in the contralateral breast of women diagnosed with cancer; in the search for an occult primary lesion in patients with axillary metastasis; characterization of dubious findings at mammography or ultrasound; determination of the local extent of the breast cancer; verification of the presence and extent of residual disease, especially in cases of histologically positive surgical margin; evaluation of response to neo-adjuvant chemotherapy; differentiation between surgical scar and tumor recurrence in patients previously treated for breast cancer; evaluation of breast implants integrity. Magnetic resonance imaging must not be utilized as a criterion for indication, or not, of histological investigation of clinically, mammographically or sonographically suspect lesions. Also, there is no study providing scientific basis for the use of MRI in the screening of breast cancer in women who are not at high risk for the disease.

After the detection of an alteration by any imaging method, its characterization is necessary for establishing the benignity or potential malignancy of the lesion. The likelihood of malignancy is determined principally by evaluation of the morphological and progression characteristics of the lesion (decrease, stability and increase along time). Many times, the practical utility of mammography, breast ultrasound and magnetic resonance imaging is limited by the relatively low specificity of these methods, leading to biopsy or early follow-up. This limitation results from the known findings overlapping of benign and malignant lesions in these imaging methods, but also is related to the standardization and understanding of the predictive value of each criterion utilized for findings interpretation.

Two studies included in the present issue of **Radiologia Brasileira** address the criteria for interpretation of findings and characterization of breast lesions.

One of them evaluates the predictive value for malignancy of BI-RADS® categories 3, 4 (A, B, C) and 5[6] in non-palpable breast lesions. The BI-RADS®[6], standardizing the definition of criteria employed for characterizing lesions at mammography, ultrasound and magnetic resonance imaging, has contributed to facilitate the comparison between different studies, and, consequently, the understanding of the findings. Additionally, it has established categories for final evaluation utilized for classifying nodules according to their probability of malignancy, facilitating the subsequent steps.

The category 0 indicates an incomplete characterization of the alteration, an additional evaluation being required. Categories 1 and 2 indicate no mammographic evidence suggesting malignancy. Category 3 indicates the presence of probably benign findings (less than 2% chance of malignancy) for which the preferential procedure is the early follow-up. The category 4 is related to a suspect abnormality for which biopsy should be considered, and is subdivided into A, B and C. Category 4A indicates findings requiring some intervention, but with low suspicion for malignancy; malignant histology is not expected and a six-month or

routine follow-up after biopsy or benign cytology is appropriate. Category 4B includes lesions with intermediate suspicion for malignancy; the findings in this category require a careful anatomoradiological correlation and the follow-up of benign findings in the biopsy of these lesions depends on this correlation. Category 4C indicates moderate concern but not classic for malignancy like category 5. Category 5 is dedicated to findings highly suggestive of malignancy, and category 6 is utilized in cases where there is already a biopsy indicating a malignant lesion. There are not many studies allowing a clear definition of which lesions are in categories 4A, 4B and 4C, as well as their respective positive predictive value.

The other study analyzes the predictive capability of breast nodules sonographic characteristics. Currently it is known that a series of characteristics are associated with a higher risk for malignancy. These characteristics are: poorly circumscribed margins, irregular shape, complex echogenicity, posterior acoustic shadowing, nonparallel orientation, echogenic halo, and changes in adjacent tissues. The sonographic identification of probably benign nodules, which are candidates to an early follow-up, requires the ruling out of any sign of malignancy, and the presence of an association with benignity criteria. This aspect implies a careful sonographic analysis, and the identification of any sign suggesting malignancy indicates the need for biopsy. The biopsy of a solid nodule found at ultrasound should not be disregarded based only on a benign finding, circumscribed margins, for example.

A consensus is being sought on solid nodules that can be sonographically classified as probably benign. Stavros et al.[7] have demonstrated that nodules with no sign of malignancy, with either ellipsoid shape and pseudocapsule or the presence of two or three lobulations and pseudocapsule, or an intense homogeneous hyperechogenicity, associated with a negative predictive value for malignancy of 99.5%; with sensitivity of 98.4%. Chala et al.[8] have reported that round-, ovoid-shaped or lobulated nodules with less than three lobulations, with circumscribed margins, parallel orientation and absence of an accentuated hypoechogenicity, posterior acoustic shadowing, calcifications and alterations in adjacent tissues, independently from echotexture and presence of pseudocapsule, presented sensitivity and negative predictive value for cancer, respectively of 98.1% and 99%.

The progress in the understanding of the predictive value of the different criteria utilized isolatedly or in combination for characterizing breast lesions detected by different imaging methods is a significant step towards reducing the number of biopsies with benign results. However, it is important to note that imaging techniques are not histological diagnostic techniques. Therefore, the biopsy with histological investigation purposes will remain necessary for many breast lesions, and the majority of such lesions, fortunately, will be benign.

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