Breast Imaging Update

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ABSTRACT

Screening mammography has been shown to reduce the number of deaths due to breast cancer. Recent data have shown that there is low patient and physician participation in screening mammography in Jamaica. Breast imaging is concerned primarily with early detection of breast cancer. Despite technological advances, mammography continues to play a pivotal role. In this report, the authors will review the available imaging modalities and their role in screening patients for breast cancer as well as the evaluation of the symptomatic patient with particular reference to the situation in Jamaica.

Estudios por Imágenes de la Mama al Día

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RESUMEN

La mamografía de tamizaje ha dado pruebas de reducir el número de muertes por cáncer de mamas. Datos recientes han mostrado que hay baja participación de pacientes y médicos en la mamografía de tamizaje en Jamaica. El estudio por imágenes de mama tiene por interés fundamental la detección precoz del cáncer de mamas. A pesar de los avances tecnológicos, la mamografía continua desempeñando un papel central. En este reporte, los autores examinarán las modalidades de diagnóstico por imagines disponibles y su papel en el tamizaje de pacientes para la detección del cáncer mamario, así como en la evaluación del paciente sintomático, con referencia particular a la situación en Jamaica.

West Indian Med J 2007; 56 (4): 351

INTRODUCTION

Breast cancer is the leading cause of cancer deaths in Jamaican women (1). Screening mammography has been shown to reduce cancer deaths by as much as fifty per cent (2, 3). As a result, mammographic screening is recommended by several organizations including the American Cancer Society (ACS)(2) and some governments, for example in the United Kingdom, fund screening programmes. Recent data have shown that there is low patient and physician participation in screening mammography in Jamaica (4). Lack of information as to the importance of early detection of breast cancer and the role of the various imaging modalities is emerging as a major factor.

Several modalities are available for breast imaging such as mammography, ultrasound, magnetic resonance imaging (MRI), positron emission tomography (PET), nuclear scintigraphy and ductography. Thermography and optical tomography are newer techniques which are largely experimental (5). Computed tomography (CT), ultrasound, MRI, nuclear medicine (including PET) and plain radiography are utilized in the evaluation of metastatic disease.

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Screening versus Symptomatic

Breast imaging may be screening or symptomatic. The screening population comprises women with no breast related symptoms. The ACS recommends that women aged 40 years and over should have an annual screening mammogram (6). A typical protocol is outlined in Figure 1. The symptomatic population includes women of all ages who have breast related symptoms, including lumps, focal pain and/or tenderness and significant nipple discharge. Their evaluation depends on the complaint and age of the patient. Figure 2 outlines a typical approach. A woman presenting for screening found to be symptomatic should be treated as a symptomatic patient.

Mammography

Current mammographic imaging includes: conventional film/screen mammography, full field digital mammography and conventional with a digital accessory, so called spot digital.

Conventional film/screen mammography utilizes a film/screen combination and X-ray tube specifically optimized for breast imaging (7). Benefits include: excellent

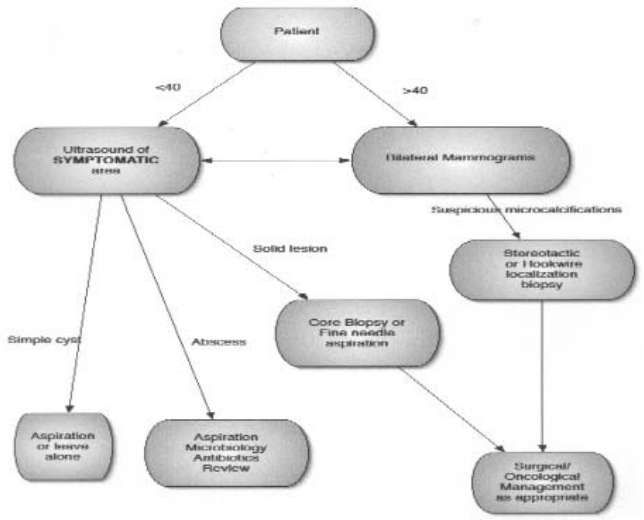

Fig. 1: Management of the screening patient.

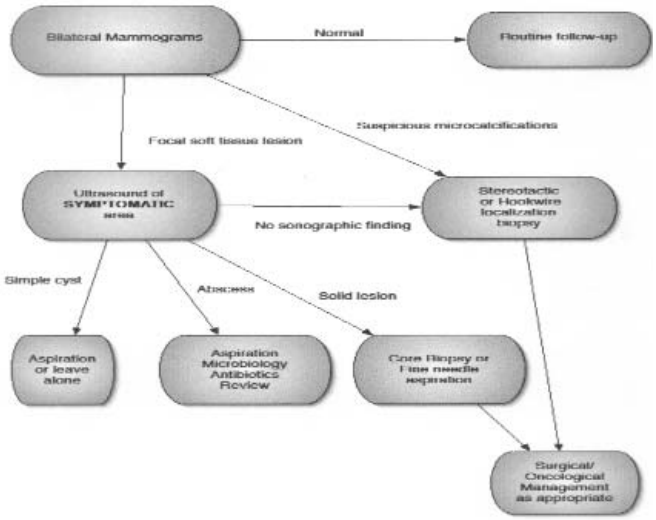

Fig. 2: Management of the symptomatic patient.

tissue contrast and resolution, relatively uniform reproducibility, good comparability with serial investigations and relative affordability. There are however some pitfalls: dense breasts may obscure soft tissue tumours; the presence of multiple benign type calcifications, also called 'busy breast' may obscure more sinister microcalcifications; post lumpectomy survey – scar tissue causes architectural distortion and may mimic cancer or obscure underlying architectural changes; evaluation of disease recurrence may be problematic and there is also the risk of observer error.

Full field digital mammography bypasses the film/ screen combination using analogue to digital conversion. The 'soft images' (viewed on a monitor) can be magnified and windowed (changing the brightness and contrast). Subtraction from previous studies, highlighting new findings, can be done, resulting in fewer repeat or additional studies (8). Stereotactic biopsy *ie* direct sampling of microcalcifications mammographically instead of using wire localization (which requires surgical removal in the main operating theatre under a general anaesthetic) is also possible with both full field and spot digital systems.

Other utilities of digital mammography include:

- computer aided detection (CAD); computer analysis of images has resulted in increased detection rate of microcalcifications (3, 9);
- contrast enhanced digital mammography (invasive cancers may enhance with iodinated contrast);
- tomosynthesis is similar to conventional tomography; suppresses overlying breast tissue, and
- telemammography: digital studies can be sent over a network (including the internet) to other centres for further evaluation (10).

Sonography

Sonography is relatively cheap, readily available and non-invasive involving no ionizing radiation. It continues to be used in the evaluation of the symptomatic patient and for further evaluation of masses detected at mammography, differentiating between solid and cystic masses and between some benign and malignant masses (5, 11). Solid masses or complicated cysts may be further evaluated using ultrasound guided biopsy or fine needle aspiration cytology. Breast sonography should be performed with an ultrasound system optimized for breast sonography, using linear probes with frequencies of at least 10Mhz (12). The pitfalls are that it is user dependent and scar tissue may shadow, obscuring underlying lesions.

Scintigraphy

Scintimammography uses radiolabelled tracers (most commonly Tc99m labelled sestamibi) to detect breast cancer. It demonstrates sensitivities averaging 80% (13) . It is however time consuming, has reduced sensitivity to the detection of lobular and papillary carcinomas and cancers less than 10 mm in diameter. It offers no biopsy capabilities.

Positron Emission Tomography

Positron Emission Tomography (PET) is used in the staging and follow-up of various types of cancer. Thus 18-Fluorodeoxyglucose (FDG), a glucose analog, is used to provide a map of glucose metabolism. Malignant cells usually have significantly increased glucose metabolism (14), hence increase uptake of FDG. It is also useful for monitoring response to therapy in patients with distant metastases and locally advanced disease. As it evaluates functional disease, it is superior to ultrasound, CT and MR in evaluation of response to therapy when discernment of residual tumour may be challenging (15).

Magnetic Resonance Imaging

Magnetic resonance imaging has high soft tissue contrast resolution giving excellent soft tissue detail and the highest sensitivity of all the breast imaging modalities, ranging from 85–100% (16): 95% for invasive ductal carcinoma, 96% for invasive lobular carcinoma and 89% for ductal carcinoma *in situ* (DCIS) (17). There is also a high sensitivity for benign pathologies but there is considerable overlap in imaging features, therefore a low specificity, ranging from 37–87% (16). A magnetic field strength of at least one Tesla is required (18). Scanning is typically done prone, with the use of dedicated breast surface coils. Most breast cancers enhance post gadolinium reflecting neovascularity, more prevalent in higher grade cancers (16). The indications are: patients with previous surgery and suspected cancer, assessing the extent of cancer, young female with dense breasts and a strong family history (brca1 and brca2 carriers) and biopsy and/or localization of lesions only visible with MRI.

The pitfalls are the tendency to overestimate the extent of a lesion (17), high cost, long scan times, restricted availability and the majority of scanners available have no biopsy capabilities (an additional cost).

Galactography

This controversial modality is used to demonstrate intraductal lesions but as it is impossible to differentiate benign from malignant tumours, ductal excision remains necessary (19). Although invasive, ductography is safe and may provide additional information in the patient with a significant (bloody or watery) nipple discharge. It may indicate the site of a lesion, important with peripherally located lesions aiding the surgeon in planning excisions (20). Benign findings such as cystic hyperplasia may be demonstrated, eliminating the need for surgery. Magnetic resonance mammary ductography offers a sensitive (though expensive) non-invasive alternative (21).

Mastalgia

Mastalgia may be unilateral or bilateral and is usually cyclical and benign, only being suspicious for underlying breast cancer when persistent and focal. The most recent audit reveals that 18% of women having mammography at the University Hospital of the West Indies (UHWI) presented because of mastalgia. Mastalgia is not an indication for mammography but age appropriate patients are screened. For underage patients (at greater radiation risk than the woman over 40 years of age) presenting for mammography with no family history of breast cancer, reassurance is usually all that is necessary.

Male Patients

Male breast cancer represents approximately 1% of all breast cancers. Due to its rarity, screening is not advocated and protocols for the evaluation of symptomatic male breast disease are not established (22). Gynaecomastia, whether physiologic in adolescents or secondary to treatment of prostate cancer, are the commonest indications for breast imaging at the UHWI. Typically, the evaluation of the male patient involves sonography of the symptomatic breast with or without tissue sampling. Mammography may also play a role.

The Jamaican Situation

In Jamaica in 2003, less than 5% of age eligible women for mammography did so (unpublished data). There is no government funded mammographic screening programme and we adhere to the ACS guidelines of beginning screening at age 40 years despite the debate on whether women below 50 years of age should be screened. There is little evidence to support the age of 50 years as a cut off point (23, 24). While increased density does decrease the sensitivity of mammography (25), age alone is not a reliable predictor of mammographic breast density (24). This has been confirmed in Jamaican women where there is a larger percentage of women below the age of 50 years with low mammographic breast density than often stated in the literature (30% compared with 10%) (26), and African American women (27). Cultural and ethnic similarities in the region would suggest that breast density is less of an issue hence screening from the age of 40 years and upwards may be appropriate for the region.

Full Field Digital Mammography is very expensive and has not been found to be more sensitive in the detection of breast cancer in the average patient. In patients with dense breasts there is increased sensitivity (28). Spot digital is a more affordable compromise where resources are limited and would allow for stereotactic biopsy. Sonography is still not recommended as a substitute for mammographic screening but is sometimes used for second level screening in women with dense breasts (29).

Magnetic resonance imaging demonstrates a high sensitivity for the detection of DCIS but cannot determine tumour grade or detect microcalcifications, and enhancement patterns are non-specific. In this regard, mammography with stereotactic biopsy remains the standard for evaluation of microcalcifications. Routine breast MRI is not offered at the UHWI as breast coils are not available. The available chest coil has been used to obtain images of diagnostic quality on follow-up patients with diagnostic dilemmas. The service will remain limited until breast coils become available. Magnetic resonance ductography requires a microscopy coil, an additional expense for a debatable procedure.

Small primary tumours can be detected by FDG PET (30), but despite high sensitivities, neither PET scanning or scintigraphy can be used for biopsies, therefore it cannot be used as screening modalities. Scanning using PET is not currently available in Jamaica. It is expensive requiring a nearby cyclotron and it is therefore unlikely that this will be locally available in the near future.

In summary, modern mammography has a false negative rate of up to 15%. Despite this, it remains the most reliable and available tool for widespread screening for breast cancer (2, 31) and continues to be recommended annually for women aged 40 years and over (5).

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