Case 7529

Diffusion Weighted Imaging and Apparent Diffusion Coefficient (ADC) measurements in the differential diagnosis of breast mass.

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Patient: 50 years, female

Clinical History:

A 50 year old female patient, with no family history, presented to our hospital to undergo screening mammography. An ultrasound and MRI examinations were also performed and the findings are presented.

Imaging Findings:

An asymptomatic middle aged female patient presented to the radiology department to undergo a routine check for breast cancer. Both her medical and family histories were unremarkable and laboratory test results were within normal limits. Mammography revealed a 1.5cm lobulated mass with no calcifications in the upper internal quadrant of the left breast (Fig 1a,b). Ultrasound examination confirmed the presence of the mass and the findings were suspicious of a malignancy (Fig 2a,b). An MRI examination was also performed in order to exclude multiplicity of the mass. On T1-weighted fat saturated images the mass demonstrated high signal intensity (Fig 3). After rapid bolus injection of Gd-DTPA dynamic contrast-enhanced images were obtained and the mass appeared as an enhanced area with a type II signal intensity/time curve (Fig 4a-e).

A diffusion weighted MR was performed and ADC maps were created. These scans revealed restricted diffusion within the mass (Fig 5a,b). The ADC values were measured 0.6-0.7 (x10^3 mm^2 sec^-1), representing malignancy. The biopsy confirmed our findings and the mass was characterized as an invasive ductal carcinoma (grade III). The nodule was radically excised.

Discussion:

Despite the improvement in the detection of breast cancer with the widespread application of mammography and ultrasound, breast lesions still remain difficult to diagnose and characterize, especially in dense fibroglandular breasts. Breast MRI is generally accepted as a very important diagnostic method for patients with breast cancer because of its high sensitivity. The main advantage of MRI of the breast is that it can improve the detection and characterization of multiple and/or small lesions even in the dense fibroglandular breasts. The use of MRI in the detection of occult breast cancers, where mammography and ultrasound present limitations in the detection and assessment of the cancer extension, has been proven. MRI of the breast is capable to reveal mammographically and sonographically hidden multifocal carcinoma. However, the disadvantages of MRI compared with mammography and ultrasound are the long scan times and the use of intravenous contrast medium with the potential danger for the patient and the increased cost of the examination.

The protocol of the MR examination consists of TI –T2 STIR sequences, dynamic contrast – enhanced imaging and
diffusion weighted imaging (DWI).
The T1-T2 weighted images are the basis of our examination and are routinely performed before the dynamic contrast enhanced imaging and the DWI. They can reveal some characteristics of the mass but they cannot differentiate benign from malignant breast masses. They also have the disadvantage that a small lesion cannot be detected in a dense breast parenchyma.

DWI identifies the biological characteristics of the tissues making use of the variability of “Brownian motion” of water molecules. This sequence was first used to evaluate acute cerebral infraction. One of its uses is to determine the malignancy of a mass. The diffusion of water molecules between the tumour cells is relatively restricted, resulting in signal hyperintensity on DWI. A benign lesion has increased water mobility; therefore the diffusion process is markedly increased resulting in signal hypointensity on DWI. In addition, DWI is capable to demonstrate some tissue characteristics otherwise not detectable, such as cell density, tumour structure and the presence of necrosis, oedema or fibrosis. The ADC values of the benign breast lesion are significantly higher that those representing a malignant one.

In our case, the breast mass presented characteristics suspicious for malignancy on mammography, US and dynamic contrast-enhanced MR examination. The DWI and the low measurements of the ADC values provided us with very important information in order to characterize the mass. The typical mamagment in such a case would be a US biopsy first. We decided to use the DWI first in order to exclude another focus and correlate our MRI findings with those of the biopsy. If we performed a biopsy first this would also distort our MRI findings. As a conclusion we can say that DWI can be used in every day practice alongside with the other diagnostic methods in order to decide the management of a patient who is presented with a breast mass.

Differential Diagnosis List: Invasive ductal carcinoma

Final Diagnosis: Invasive ductal carcinoma

References:


**Figure 1**

*Description:* a) longitudinal ultrasound scan, with 18mHz transducer, shows an oblong, hypoechoic lobulated mass with irregular margins. *Origin:*
Description: b) tranverse scan. Origin:
Description: a) mediolateral oblique Lobulated lesion with no calcifications

Origin:
Description: and b) craniocaudal view. Origin:
**Figure 3**

*Description:* The lesion demonstrated high signal intensity

*Origin:*
Figure 4

**a**

![Image](image_url)

**Description:** A) Consecutive images -
The lesion appeared as an enhanced area **Origin:**

**b**

![Image](image_url)

**Description:** B) Quick uptake of paramagnetic contrast medium **Origin:**
Description: E) Type II signal intensity/time curve Origin:
**Figure 5**

**a)** DWI sequence, The lesion revealed high signal intensity on DWI.

**b)** ADC map, Low signal intensity on the corresponding ADC map, with low ADC values, representing an area of restricted diffusion.