Pure mucinous carcinoma of the breast: mammographic and sonographic presentation can be tricky.

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Purpose

Mucinous carcinoma, or colloid carcinoma, is a carcinoma that contains large amounts of extracellular extraluminal mucus in direct contact with the stroma [1]. Mucinous carcinoma is an uncommon carcinoma that accounts for about 1%-7% of all invasive mammary carcinomas [1, 2]. It usually occurs in an elderly women [1, 3-5] and it has a better prognosis than infiltrating ductal carcinomas [6].

Most well-circumscribed breast masses are benign lesions; nevertheless, 10%-20% of breast malignancies are well-circumscribed masses, and these malignancies include papillary, mucinous, medullary and malignant phyllodes tumors. It is very important to differentiate these breast malignancies from benign lesions, but this can be difficult based on conventional imaging modalities such as mammography and ultrasonography [5].

Magnetic Resonance imaging can be a useful tool in characterizing well-circumscribed carcinomas. Analysis of the lesion signal intensity on nonenhanced T2-weighted images, determination of the enhancement pattern, and kinetic curve assessment can greatly help differentiate malignant from benign well-circumscribed breast lesions [7].

The aim of the present study was to determine the value of breast magnetic resonance imaging (MRI) in the correct identification of pure mucinous carcinoma of the breast compared to mammography and ultrasound (US) examinations.
Methods and Materials

Patients

A computerized search of radiologic and pathologic information system from January 2002 and August 2011 helped identify thirty-seven patients with histopathologically proven mucinous breast cancers at percutaneous biopsy. We have excluded all patients without surgical specimen histopathological diagnosis or with different diagnosis (8) on surgical specimen, those with diagnosis of mixed-type mucinous carcinoma (4) and those that did not receive preoperative breast MRI in our institution (6). The remaining 19 patients constituted our study population.

Radiological methods

Mammographics images were obtained in two standard projections (mediolateral oblique and craniocaudal). Dedicated full-field digital equipment was used.

Whole-breast sonography of all women was performed using a broadband 10-13-MHz or 12-15-MHz linear array.

Percutaneous biopsy was performed using stereotactic or sonographic guidance according to the visibility of the lesion. In none of these cases was percutaneous biopsy performed under MR guidance.

In 17 of 19 lesions (89%), biopsy was performed under sonographic guidance using an automated biopsy gun or a semiautomated biopsy gun with a 14-gauge needle. A mean of five core samples (range, 3-8) were obtained per lesion.

In 2 of 19 cases (11%), biopsy was performed under stereotactic guidance using a vacuum-assisted system with a 11-gauge needle. A mean of nine core samples (range, 6-12) were obtained per lesion.

MR examinations were performed on a 1.5 T scanner with a dedicated bilateral surface breast coil and the patient in prone position. Sequences were acquired in the following order: STIR T2 weighted and FLASH T1 weighted. Afterwards, Gadobenate dimeglumine 0.5 M was administered intravenously as an automated bolus injection at a dose of 0.1 ml/kg body weight with a flow rate of 2 ml/s, followed by flushing of 20 ml of saline, using an automatic injector. Serial dynamic T1 weighted images, identical to those obtained before contrast agent administration, were acquired five times after the start of injection. Post-processing and construction of dynamic curves were performed. Post-processing included temporal subtraction (all contrast-enhanced series minus
non-contrast-enhanced series), the acquisition of multi-planar reconstruction (MPR) and maximum intensity projections (MIP). Dynamic signal intensity-time curves were constructed for Regions Of Interest (ROI - 3x3 pixels) positioned within the lesion on subjectively determined areas of maximal enhancement.

**Radiological classification**

Mammographic, ultrasound and MR images were independently evaluated by two experienced breast radiologists; images were presented randomly to each reader in one imaging session. Radiologist categorized images according to ACR BI-RADS lexicon [8] and disagreement on interpretation was resolved in consensus.

Category 0 / Need Additional Imaging Evaluation

Category 1 / Negative

Category 2 / Benign Finding

Category 3 / Probably Benign Finding - Short Interval Follow-Up Suggested

Category 4 / Suspicious Abnormality - Biopsy Should Be Considered

Category 5 / Highly Suggestive of Malignancy - Appropriate Action Should Be Taken

**Data analysis**

Frequencies of different BI-RADS category for each technique were calculated.
Results

The mean age of our 19 patients at diagnosis was 61 years (range 32-78 years).

Of the 19 patients, 10 (53%) were symptomatic, showing a palpable nodule.

Of five patients we did not have mammography because the investigation was done in another place. Two cases (14%) were mammography-occult (BI-RADS 1); therefore the sensitivity of this technique was 86%.

The most common mammographic appearance was a well-circumscribed mass, most often with well-defined margins. Calcifications were seen in two tumors and architectural distortion only in one lesion.

On mammography, 50% of lesions were classified as BI-RADS 3 (Probably Benign Finding), 21% as BI-RADS 4 (Suspicious Abnormality) [Fig. 1] and 14% as BI-RADS 5 (Highly Suggestive of Malignancy). None of the tumors was classified as BI-RADS 2.

Of 19 lesions, 2 (11%) were not detected by sonography (BI-RADS 1), and the sensitivity of this technique was 89%.

Hypoechoic lesions were recognized in 13 cases (76%) [Fig. 2], isoechoic lesions in 3 cases (18%) [Fig. 3] and hyperechoic lesion in 1 case (6%); homogeneous internal echotexture was present in 13 cases (69%), while the remaining six lesions (31%) were heterogeneous.

On ultrasound, 42% of lesions were classified as BI-RADS 3 [Fig. 4], 26% as BI-RADS 4 and 21% as BI-RADS 5. None of the tumors was classified as BI-RADS 2.

The average tumour size were 14 mm for mammography and 15 mm for ultrasound investigations.

MRI demonstrated of all mucinous carcinomas.

Oval shape with irregular margins was the most common MRI morphologic feature [Fig. 5, 6].

Kinetic analysis was possible in 17 lesions (in 2 cases kinetic analysis was not performed because of the presence of movement artefacts), and the initial enhancement was medium in 1 lesion (6%) and rapid in 16 lesion (94%). None of the lesions presented slow initial enhancement. The delayed phase pattern was persistent in 3 lesions (18%), plateau in 8 (47%) and wash-out in 6 (35%). [Fig. 7]
Hyperintensity of the lesions on STIR T2-weighted images was present in 15 cases (79%). [Fig. 8]

Rim enhancement was present in 6 cases (32%). [Fig 9]

On MRI 21% of lesions were classified as BI-RADS 4 and 79% as BI-RADS 5 [Fig 10]. None of the tumors was classified as BI-RADS 1, 2 or 3. The average tumour size was 21 mm for MRI.
Mammographic and ultrasonographic finding of a palpable lesion in a 65-years-old woman. Craniocaudal (a) and mediolateral oblique mammograms (b) show a polilobulated well-circumscribed high-density mass in lower quadrants of right breast; BI-RADS 4. (c) On the US the lesion appears as a polilobulated hypoechoic solid lesion; BI-RADS 4. Final histology revealed mucinous carcinoma.
Ultrasonographic finding of a 77-years-old patient. US scan shows a circumscribed solid hypoechoic lesion with oval shape and mainly well-defined margins; color-Doppler evaluation shows no vascularization (BI-RADS 3). The mammogram was negative. Final histology revealed mucinous carcinoma.
Ultrasonographic finding of a right breast mucinous carcinoma of a 67-years-old patient. US scan shows a circumscribed solid isoechoic lesion (a), without significative vascularization (b) (BI-RADS 3)
Breast sonograms in a 78-years-old woman demonstrate a solid hypoechoic mass, with oval shape and well-circumscribed margins, with posterior acoustic accentuation (a), non-vascularized (b). (BI-RADS 3). Final histology revealed mucinous carcinoma.
Dynamic contrast enhanced breast MRI with MIP reconstruction of a mucinous tumor of the left breast in 69-years-old patient shows the presence of a mass-like area of intense and heterogeneous enhancement.

Fig. 5

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MRI findings of fig. 3 lesion.

MRI shows a mass-like area of intense enhancement in the right breast, with oval-like shape and well defined margins. Final histology revealed mucinous carcinoma.
Dynamic curve of fig. 6 lesion.
Plateau-curve with rapid enhancement ratio.

Fig. 7

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Hyperintensity of the lesion showed in fig. 6 on STIR T2-weighted images.

According to overall MRI features, this case was classified as BI-RADS 4. Final histology revealed mucinous carcinoma.
MR image of a pure mucinous carcinoma of right breast of a 65-years-old patient demonstrates intense rim-enhancement. BI-RADS 5.
Fig. 10

Frequencies of different BI-RADS category for each technique

Fig. 10

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Conclusion

The mammographically and sonographically benign appearance of pure mucinous carcinoma can easily cause a delay in diagnosis. Diagnosis of mucinous carcinoma is reported to be delayed in as much as 38% of cases due to a mammographically benign appearance [9].

The mammographic and ultrasonographic features of mucinous breast carcinoma can be misleading for the radiologist, in particular in the setting of mammographic screening, where additional imaging examinations are performed just in case of suspicious/indeterminate mammographic findings [9].

Conversely breast MRI demonstrated high sensitivity and high accuracy in the identification and characterization of pure mucinous breast cancer, helping the radiologist to make early diagnosis.
References


