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Magnetic resonance imaging features of papillary breast lesions

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ABSTRACT

Purpose: This study was aimed to assess the role of magnetic resonance imaging (MRI) in the evaluation of the papillary lesions of the breast and their morphological relationship with the mammary ducts. The potential diagnostic contributory role of ductal oriented protocols to conventional dynamic magnetic resonance examination was also explored.

Materials and methods: Retrospective data were collected from 46 patients who had been diagnosed with papillary breast lesions and undergone magnetic resonance examination.

The presence of dilated ducts and their morphological relation with the lesion were recorded. Lesions were classified as follows: papilloma, papillomatosis and malignant papillary lesion. Statistical difference between groups was studied for each morphological and dynamic lesion characteristic.

Results: Dilated ducts and characteristics of intraductal material can be identified by magnetic resonance imaging. Certain MRI findings such as a mass with crescentic peripheral fluid or focal intraductal mass on T2 weighted images may suggest the presence of an intraductal/papillary lesion. In this respect, non-fatsat T2 weighted images appear particularly useful. There was a significant difference between papilloma and papillomatosis with regard to segmental and heterogeneous contrast enhancement ($p < 0.05$ for both comparisons). In addition, there was a significant difference between papillomas and carcinomas with regard to homogenous, heterogeneous and segmental contrast enhancement ($p < 0.05$ for all). On the other hand, papillomatosis and carcinoma did not differ significantly in terms of any of the morphological or dynamical MR criteria compared.

Conclusion: Papillary lesions can be detected by MRI. Despite some overlaps in MRI findings between carcinoma, papilloma and papillomatosis, MRI may help differentiate these lesions. Major benefit of retroareolar imaging appears to arise from its ability to demonstrate ductal relation and extension of contrast enhanced regions.

1. Introduction

Papillary lesions of the breast may pose several diagnostic challenges due to diversity of radiological imaging findings, their small size, non-palpability, multi-site occurrence, and absence of nipple discharge. Symptoms of nipple discharge and palpable mass have been reported to be absent in 60.4% and 38.5% of papilloma patients, respectively [1,2]. Hence, detection of intraductal papillomas mainly depends on imaging findings.

The standard diagnostic work-up for papilloma includes mammography, ultrasonography and galactography, while some radiologists also perform directed sonography for the retro-areolar region.

Breast magnetic resonance imaging (MRI) demonstrates a high sensitivity (between 40% and 100%) for noninvasive breast disease [3], while sensitivity may reach up to 87% for high grade DCIS [4]. These figures provide evidence for the potentially high sensitivity of MR imaging in the detection of intraductal disease.

In the present study, the role of magnetic resonance imaging in the evaluation of the papillary lesions of the breast and their morphological relationship with the mammary ducts have been examined, as well as the potential diagnostic contribution of ductal-oriented MRI to conventional dynamic MRI examination in these conditions.

2. Materials and methods

Retrospective data on a total of 51 patients who had a suspicious papillary lesion and underwent an MRI examination were collected. Of the five cases excluded from our study, four had other medical conditions such as cardiac pathology that precluded surgery and they were managed by follow-up only. The fifth patient did not attend to follow-up visits despite the cytological documentation

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Table 1
Distribution of ductal signs among the groups (three cases that had DCIS and invasive carcinoma were excluded from the papillomatosis group).

	Papilloma ($n = 22$)	Papillomatosis ($n = 10$)	Papillary carcinoma–papillary lesion + DCIS (n14)
Discharge	8 (36%)	3 (30%)	3 (21%)
Dilated duct and precont low t1 signal	1 (5%)	0 (0%)	0 (0%)
Dilated duct and precont high t1 signal	5 (22%)	1 (10%)	1 (7%)
Dilated duct and intraductal focal mass-like T2 signal	1 (5%)	2 (20%)	0 (0%)
Solid mass with crescentic peripheral fluid	1 (5%)	2 (20%)	2 (14%)
Contrast enhanced area related with dilated duct	5 (23%)	2 (20%)	1 (7%)

of papillary cells in nipple discharge specimens. Thus, a total of 46 patients with papillary lesions who underwent MRI examination were included in the study. Reasons for referral included high risk of malignancy, palpable abnormality, mammographic or sonographic abnormality, and nipple discharge. Patients with additional benign or malignant entities that were identified pathologically were not excluded from the study.

MRI was performed using a 1.5-T magnet (Magnetom Avanto, Siemens Medical Solution, Erlangen, Germany) with a dedicated bilateral breast surface coil with prone position. The imaging protocol and parameters were as follows: axial T1-weighted image (TR/TE, 450/11) and non–fat-suppressed T2-weighted turbo spin-echo image (3740/122) of both breasts were obtained with 3 mm slice thickness. Next, T1-weighted dynamic images were acquired using a 3D FLASH (fast low-angle shot pulse sequence) without fat suppression through both breasts (TR/TE 5.19/2.38 flip angle 10). T2-weighted short-tau inversion recovery (STIR) sequences were obtained in the coronal plane (TR/TE 5900/78; and IR 130 slice thickness 4.5 mm; FOV 40 × 40 cm).

Also non-fat-suppressed T2-weighted turbo spin-echo images were obtained, with 30–35 sections and a full 512 × 512 imaging matrix. The contrast-enhanced dynamic series consisted of 60 sections, each T2 weighted image with 3 mm slice thickness being compensated with two dynamic images with a slice thickness of 1.5 mm without gap. Contrast-enhanced dynamic series exactly matched the T2-weighted images to allow an accurate comparison of signal intensity.

First T1-weighted 3D FLASH sequence was acquired before administration of contrast material in the axial planes. Sequential postcontrast multisection whole-breast images were obtained five times in the same plane with 20-s intervals.

Unilateral retroareolar examination was performed on the breast when a lesion had previously been determined by other imaging modalities or the lesion had been associated with clinical complaints. For unilateral retroareolar imaging, pre- and post-contrast coronal fat saturated 2D FLASH (TR/TE 479/5.83 FOV 150 × 150 384 × 230 matrix 3.5 mm slice thickness) and T2 TSE 3D sequence with same FOV and matrix (TR/TE 750/147slice thickness 1 mm) were used.

Intravenous gadolinium-gadobenate dimeglumine (DTPA) (MultiHance, Bracco, Milan, Italy) was administered at a rate of 2 ml/s via an automatic injector at a dose of 0.1–0.2 mmol/l per kilogram of body weight, together with a 10-ml bolus of saline solution.

All MRI examinations were interpreted by radiologists with special expertise on breast MRI for more than 5 years. However, radiologists were not blinded to the patient data.

The largest diameter of the tumor measured on a subtracted image from the series obtained 2 min after contrast injection was recorded as the size of the papilloma. The presence of dilated ducts and their relation with the lesion were also recorded (Table 1).

The nomenclature in the American College of Radiology's Breast Imaging Reporting and Data System (BI-RADS) was used for describing the morphologic characteristics of the lesions [5] (Table 2). For analysis of enhancement kinetics, time–intensity curves were plotted from the signal intensity values obtained from the most enhanced part of the lesion. Time–intensity profile was also classified into the following 3 types according to phase analysis of peak enhancement and washout of contrast enhancement: (a) in the washout type, peak enhancement was seen within 120 s (early phase) and followed by a decrease; (b) in the plateau type, enhancement increased in the early phase and followed by a plateau; and

Table 2
Evaluation of morphologic criteria of groups.

	Papilloma ($n = 22$)	Papillomatosis ($n = 10$)	Papillary carcinoma–papillary lesion + DCIS (n14)
Shape			
Round	3 (13%)	2 (20%)	2 (14%)
Lobulated	13 (59%)	1 (10%)	5 (36%)
Irregular	0 (0%)	1 (10%)	3 (21%)
Border			
Well defined	12 (54%)	3 (30%)	9 (64%)
Microlobulated	1 (5%)	1 (10%)	0 (0%)
Indistinct	3 (13%)	1 (10%)	1 (7%)
Contrast pattern			
Homogeneous	15 (68%)$^{+}$	2 (20%)	1 (7%)$^{+}$
Heterogeneous	1 (5%)$^{*,+}$	2 (20%)*	7 (50%)$^{+}$
Rim enhancement	1 (5%)	1 (10%)	3 (21%)
Nonmass-like			
Ductal	5 (23%)	1 (10%)	6 (42%)
Segmental	0 (0%)$^{*,+}$	3 (30%)*	4 (29%)$^{+}$
Regional	0 (0%)	0 (0%)	1 (7%)
Multiple mass-like	2 (9%)	2 (20%)	0 (0%)
Clustered ring enhancement	0 (0%)	1 (10%)	0 (0%)
Focal nodulary-punctate	0 (0%)	1 (10%)	0 (0%)

The two groups with the sign * – * have statistically significant differences ($p < 0.05$).
The two groups with the sign + – + have statistically significant differences ($p < 0.05$).