Can Breast MRI Differentiate Phyllodes Breast Tumors from Fibroadenomas?

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Abstract

Objective: The purpose of this study was to evaluate if MR imaging could differentiate phyllodes breast tumors and fibroadenomas.

Materials and Methods: Dynamic contrast enhanced MR imaging was performed for six patients with six phyllodes breast tumors and results were compared with respect to morphology and contrast enhancement with those of 69 fibroadenomas of 50 patients.

Results: Smooth margins were seen in 83.3% of the phyllodes tumors and 93% of the fibroadenomas and a round, oval or lobulated shape in 100% and 98.6%, respectively. A heterogeneous internal structure was observed in 50% of phyllodes tumors and in 33.3% of fibroadenomas. Cystic changes were found in 50% of phyllodes tumors and 3% of fibroadenomas. Most of both lesions appeared with high signal intensity on T2-weighted images. A significantly greater increase in signal was seen on T2-weighted images in the tissue surrounding one of the phyllodes tumors (16.7%). After the administration of contrast material, 33.4% of phyllodes tumors and 21.7% of fibroadenomas showed a suspicious signal intensity-time course.

Conclusion: Phyllodes breast tumors and other fibroadenomas cannot be accurately differentiated on breast MR imaging.

Key Words: MR mammography – Fibroadenoma – Phyllodes breast tumors.

Introduction

PHYLLODES tumors account for less than 1% of mammary tumors and represent approximately 2%-3% of fibroepithelial neoplasms of the breast. Like fibroadenomas, phyllodes tumors are composed of epithelial elements and a connective tissue stroma, but phyllodes tumors have higher stromal cellularity [1]. In contrast to other fibroadenomas, the phyllodes breast tumor has the potential to grow to a large size. The tumors recur if not removed completely [2]. Approximately 20%-50% of phyllodes tumors are reported to be malignant [1].

The appearance of these breast tumors on sonography and mammography usually does not allow the distinction of a fibroadenoma and a phyllodes breast tumor that needs therapy [3]. Moreover, fine-needle aspiration cytology cannot be used to distinguish a fibroadenoma from a benign phyllodes tumor [4].

Therefore, the possibility of differentiation of phyllodes breast tumors from fibroadenomas on dynamic breast MR imaging was evaluated in this study.

Material and Methods

This study was conducted through the period from March, 2006 till March, 2008. A total of 56 patients were included in this study (mean age, 38.6 years; range, 21-55 years). These patients were referred to the radiology department (King Fahd Military Medical Complex), for mammography/ultrasound or both, because of mastalgia or breast masses. They had breast masses that were, clinically and radiologically, highly probable to be benign, for which they underwent dynamic breast MR imaging (MRI) followed by excisional biopsy, which showed phyllodes tumors or other fibroadenomas. Patients gave their informed consent to mammography and MRI.

MR imaging was performed with the patient in the prone position in a dedicated phased-array...
breast coil. A 1.5-T unit (Signa; GE Medical Systems, Milwaukee, WI) was used.

Transverse T1-weighted MR images (repetition time msec/echo time msec, 718/14; two signals acquired; field of view, 32-40 cm; section thickness, 5 mm) were obtained in both breasts, followed by sagittal T2-weighted fat-suppressed (6700-7072/68-88; two signals acquired; field of view, 18 cm; section thickness, 4 mm) images for each breast separately. T1-weighted MR imaging was then performed by using a three-dimensional spoiled gradient-recalled echo pulse sequence to acquire eight frames of sagittal volumetric images continuously over time, spatially covering the whole breast. Parameters were as follows: 9.0/3.8 (repetition time msec/echo time msec), 30° flip angle, 5-mm section thickness, 24-cm field of view and 64 x 256 matrix size. Each frame of images typically contained 18-26 sections, depending on the breast size; this resulted in an acquisition time of 10-15 seconds for each frame. At the start of the second frame data acquisition, intravenous injection of 0.1 mmol per kilogram of body weight of gadopentetate dimeglumine (Magnevist; Schering, Berlin, Germany) was done, over 20 seconds with a power injector (Spectris; Medrad, Indianola, Pa); this was followed with a 15-mL flush of isotonic saline solution.

The dynamic sequence was reviewed with subtraction and maximum intensity projection (MIP) techniques. Kinetic analysis was performed for regions of interest that were either drawn around all or part of the lesions according to their sizes (smaller or larger than 5 mm). Lesion morphology and kinetics were evaluated for all enhancing lesions.

The following data were recorded: margins of the breast masses (smooth or irregular), shape (round, oval, lobulated or irregular), internal structure (homogeneous, heterogeneous), signal intensity of the lesion and the surrounding tissue on T2-weighted images (compared with tissue of the breast), signal intensity of the lesion on T1-weighted images and contrast enhancement characteristics with signal intensity course after contrast administration (slow initial contrast enhancement with persistent delayed phase, fast initial contrast enhancement with plateau phase, or fast initial contrast enhancement with wash-out phenomenon).

Comparison of the data in the group with phyllodes breast tumors and the group with other fibroadenomas was performed using Fisher’s exact test, with the level of significance set at \( p < 0.05 \).

**Results**

**Age of patients:**

The mean age of patients with fibroadenomas is 38.7 years; while that of patients with phyllodes tumors is 37.7 years.

**Size of lesions:**

Tumor sizes of the benign phyllodes breast tumors ranged from 15 to 60 mm (average size, 31 mm). Two tumors were between 10 and 20 mm, and four tumors were larger than 20 mm. The size of fibroadenomas ranged from 3 to 50 mm (average, 15.5 mm). There were 11 fibroadenomas smaller than 10 mm, 51 fibroadenomas between 10 and 20 mm and 7 tumors larger than 20 mm.

**Morphology:**

Phyllodes tumors which had smooth margins were 83.3% (n=5), while only 16.7% (n=1) had irregular margins. 93% (n=64) of fibroadenomas had smooth margins, while 7% (n=5) had irregular margins.

All phyllodes tumors were round, oval or lobulated (100%), while most of fibroadenomas were similar (98.6%, n=68).

Homogeneous internal structure was noted in 50% (n=3) of phyllodes tumors (Fig. 1) and 66.6% (n=46) of fibroadenomas. A similar number of phyllodes tumors had heterogeneous structure, while 33.3% (n=23) of fibroadenomas were internally heterogeneous (Fig. 2). 100% of the latter phyllodes lesions were more than 20 mm, while 33.3% of these fibroadenomas were as such. 33.3% of the former phyllodes lesions were more than 20 mm, while 4.3% of those fibroadenomas were as such.

**Signal intensity:**

The phyllodes breast tumors and fibroadenomas were hypointense or isointense lesions compared with adjacent breast tissue on T1-weighted images. On T2-weighted images, two (33.3%) of six phyllodes tumors and 20 (29%) of 69 fibroadenomas had a hypointense signal. Four phyllodes breast tumors were hypointense, while 49 fibroadenomas (71%) had hyperintense signal intensity. The surrounding breast tissue had high signal intensity on T2-weighted images in only one of six (16.7%) phyllodes breast tumors and in none of the fibroadenomas.

**Contrast enhancement characteristics:**

Three types of contrast medium enhancement patterns were differentiated: The type 1 enhance-
ment pattern indicated benign lesions and types 2 and 3 patterns were suggestive of malignancy. In the type 1 pattern, there is slow initial contrast enhancement and a persistent delayed phase. The type 2 contrast enhancement pattern is with fast initial contrast enhancement and a plateau phase, while type 3 pattern shows fast initial contrast enhancement and a wash-out phenomenon [5-6].

Four (66.7%) of phyllodes breast tumors and 54 (78.3%) of fibroadenomas showed type 1 contrast enhancement pattern. One of the phyllodes tumors (16.7%) and nine fibroadenomas (13%) showed type 2 contrast enhancement pattern. Also, one of the phyllodes tumors (16.7%) and six fibroadenomas (8.7%) showed type 3 pattern. Table (1) describes the details of the MRI findings in the patient population.

Table (1): Morphologic characteristics of phyllodes breast tumors and fibroadenomas on MRI.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Phyllodes tumor (n=6)</th>
<th>Fibroadenomas (n=69)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Margin:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth</td>
<td>5 (83.3%)</td>
<td>64 (93%)</td>
</tr>
<tr>
<td>Irregular</td>
<td>1 (16.7%)</td>
<td>5 (7%)</td>
</tr>
<tr>
<td><strong>Shape:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round/Lobulated</td>
<td>6 (100%)</td>
<td>68 (98.6%)</td>
</tr>
<tr>
<td>Irregular</td>
<td>–</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td><strong>Internal structure:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homogeneous</td>
<td>3 (50%)</td>
<td>46 (66.7%)</td>
</tr>
<tr>
<td>Heterogeneous</td>
<td>3 (50%)</td>
<td>23 (33.3%)</td>
</tr>
<tr>
<td>Cystic changes</td>
<td>3 (50%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>Septations</td>
<td>–</td>
<td>22 (32%)</td>
</tr>
<tr>
<td><strong>Signal intensity on T2WIs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>2 (33.3%)</td>
<td>20 (29%)</td>
</tr>
<tr>
<td>High</td>
<td>4 (66.7%)</td>
<td>49 (71%)</td>
</tr>
<tr>
<td><strong>Contrast enhancement pattern:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1</td>
<td>4 (66.7%)</td>
<td>54 (78.3%)</td>
</tr>
<tr>
<td>Type 2</td>
<td>1 (16.7%)</td>
<td>9 (13%)</td>
</tr>
<tr>
<td>Type 3</td>
<td>1 (16.7%)</td>
<td>6 (8.7%)</td>
</tr>
</tbody>
</table>

Fig. (1): 49 years old female who presented with breast mass. Three-dimensional spoiled gradient-recalled (a) pre and (b) first postcontrast MR images, showing enhancing homogeneous well-defined mass (arrows), proven by biopsy to be phyllodes tumor.
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Fig. (2): 27 years old female who presented with breast mass. Three-dimensional spoiled gradient-recalled (a) pre and (b) first postcontrast MR images. Only in (b) the lesion appears as (enhancing) heterogeneous mass with internal septations (arrows), proven by biopsy to be fibroadenoma.

Discussion

Dynamic breast MRI has proven to be an additional tool to the conventional methods of mammography and breast sonography for breast cancer diagnosis [7-8]. Despite its limited specificity, dynamic breast MRI helps to differentiate between benign and malignant breast lesions [5-6]. Whether it can clearly differentiate benign breast lesions such as fibroadenomas and phyllodes breast tumors that require different therapeutic procedures was not sufficiently investigated.

The mean age of patients with fibroadenomas is 30 years; in contrast, that of patients with phyllodes tumors is about 45 years. However, phyllodes tumors may also occur in adolescent girls and young women [9,10]. On contrast, the mean age of patients with fibroadenomas in this study was 38.7 years; while that of patients with phyllodes tumors was 37.7 years.

The number of phyllodes breast tumors reported on MRI is limited. Well-defined margins with a round or lobulated shape have been described as characteristic. All phyllodes tumors in this study have these characters. In our study, fibroadenomas showed a, nearly similar, high percentage with a round or lobulated shape, as in the study of Hochmann et al., 1997 [11].

We found a nonsignificant difference in heterogeneous inner structure, with 50% for phyllodes breast tumors and with 33.3% for fibroadenomas. We found an equal percentage of heterogeneous and homogeneous tumors in the phyllodes group. This does not match with Chao et al. [12] who concluded that a phyllodes tumor should be considered when a round or lobulated tumor shows a heterogeneous inner structure. The difference between their study and ours could be due to small number of phyllodes tumors in our study.

Some case studies have described cysts as typical signs of phyllodes breast tumors [13,14,15]. 50% of phyllodes tumors in this study showed cystic changes compared to only 3% of fibroadenomas. In the mentioned studies, only large tumors were analyzed. Similarly, all phyllodes tumors with cystic changes in our study were larger than 20mm, which formed 75% of phyllodes tumors of this size (three of four tumors).

Signal intensity on T2-weighted images was high in high percentage of tumors in both groups (66.7% of phyllodes tumors and 71% of fibroadenomas). Kuhl et al. [16] showed high signal intensity on T2-weighted images in 62-76% of fibroadenomas.

One phyllodes tumor showed surrounding unilateral edema. The tumor was larger than 20mm. Grebe et al. [13] also found edema surrounding a large phyllodes tumor. The interstitial edema of tissue was interpreted as a liquid collection in rapidly growing tumors in compressed mammary ducts or lymph vessels.

Previous studies described up to 18% of suspicious enhancing, benign lesions (types 2 and 3 contrast enhancement patterns) [6,17,18]. 33.4% of phyllodes breast tumors and 21.7% of fibroadenomas in our study showed types 2 and 3 patterns of contrast enhancement. Kinoshita et al. [15] also showed benign and malignant enhancement patterns in eight phyllodes tumors.
Phyllodes breast tumors may have a typical morphology with internal cysts and heterogeneity or perifocal edema, but a reliable differentiation of phyllodes tumors and fibroadenomas using contrast enhanced MR imaging was unfortunately, not possible in this study.

References