

Indications for breast magnetic resonance imaging in an oncology reference center*

Indicações de ressonância magnética das mamas em um centro de referência em oncologia

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Abstract Objective: To evaluate and discuss the indications for breast magnetic resonance imaging in an oncology reference center. **Materials and Methods:** Retrospective study approved by the Committee for Ethics in Research of the institution and developed through a review of patients' records and clinical reports. All the breast magnetic resonance studies performed in the period from July 2008 to July 2009 ($n = 529$) were included. **Results:** Mean patients' age was 49 years, ranging from 17 to 86 years. Family history of breast and/or ovarian cancer was present in 162 patients (30.6%). Most common indications for breast magnetic resonance imaging included inconclusive mammographic/sonographic findings (48.8%), evaluation of tumor recurrence/surgical scar after breast surgery (15.1%), disease staging/surgical planning (11.7%) and screening in high-risk patients (8.5%). **Conclusion:** In spite of inconclusive findings at conventional imaging studies being the most common indication for breast magnetic resonance imaging, there is no evidence in the literature supporting such a conduct. Because of its high sensitivity and high rate of false positive results, magnetic resonance imaging should be appropriately indicated in order to avoid unnecessary procedures. Once such method is appropriately indicated, it may contribute in the decision making process, constituting an essential tool in the assessment of breast lesions. **Keywords:** Magnetic resonance imaging; Breast neoplasms; Early detection of cancer.

Resumo Objetivo: Avaliar e discutir as indicações de ressonância magnética das mamas em um centro de referência oncológico. **Materiais e Métodos:** Estudo retrospectivo, aprovado pelo Comitê de Ética e Pesquisa da instituição, conduzido através da revisão de prontuários e laudos médicos. Foram incluídos todos os exames de ressonância magnética das mamas realizados no período de julho de 2008 a julho de 2009 ($n = 529$). **Resultados:** A idade média das pacientes foi de 49 anos, variando de 17 a 86 anos. História familiar de câncer de mama e/ou ovário esteve presente em 162 pacientes (30,6%). As indicações mais comuns de ressonância magnética das mamas foram esclarecimento de achados inconclusivos na mamografia e/ou ultrassom (48,8%), avaliação de recorrência tumoral/cicatriz cirúrgica (15,1%), estadiamento/planejamento cirúrgico (11,7%) e rastreamento de pacientes de alto risco (8,5%). **Conclusão:** Apesar de achados inconclusivos nos exames convencionais serem a indicação mais comum de ressonância magnética das mamas, não há evidências que justifiquem esta conduta na literatura. Em razão da sua alta sensibilidade e percentual de falso-positivos, este exame deve ser adequadamente indicado, para evitar a realização de procedimentos desnecessários. Se bem indicada, a ressonância magnética pode contribuir para o processo de tomada de decisão e constitui uma ferramenta fundamental na avaliação de lesões mamárias.

Unitermos: Imagem por ressonância magnética; Neoplasias da mama; Detecção precoce de câncer.

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INTRODUCTION

Breast cancer is the leading cause of cancer deaths among women in Brazil⁽¹⁾. However, its prognosis may be considered as good, provided the disease is early diagnosed and treated.

Mammography is the primary diagnostic method for evaluating breast cancer, with 60–90% sensitivity. This method is utilized in the screening among women above the age of 40 because of its high sensitivity, low cost and low level of radia-

tion exposure. Programs aimed at early detection of tumors by means of periodic mammographic studies have reduced the breast cancer mortality in 25–32%⁽²⁾.

Ultrasonography (US) has also become a relevant evaluation tool in the management of breast cancer, since it can identify small nodules besides being useful in the elucidation of lesions otherwise inconclusive at mammography. However, the main disadvantage of this method is its significant operator dependence⁽³⁾.

Besides mammography and US, other

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diagnostic methods have been considered for early diagnosis of breast cancer. Magnetic resonance imaging (MRI) has been the most utilized, allowing the assessment of the lesions vascularization by means of intravenous administration of paramagnetic contrast agents⁽⁴⁾. According published studies⁽⁵⁾, MRI presents higher sensitivity (94–99%), but a highly variable specificity (37–86%). Such a variation in specificity involves several factors particularly related to the lack standardization in the imaging protocols and appropriate indications for this imaging modality^(6,7).

Considering that the use of MRI was just recently disseminated (in the 1990's), the method still lacks standardization, and the centers present different indications for patients with a single clinical/radiological profile⁽⁶⁾.

The main objective of the present study is to evaluate and discuss the indications for breast MRI in an oncology reference center.

MATERIALS AND METHODS

The present study was approved by the Committee for Ethics in Research of the institution and involved a retrospective analysis of clinical records and imaging reports of women who underwent breast MRI in the period from July 1st, 2008 to July 31, 2009.

A standard form was filled in for all the patients included in the study, with demographic and clinical data, besides previous imaging studies results and indication for breast MRI. Previous mammographic results were categorized according to the Breast Imaging Reporting and Data System (BI-RADS[®]) lexicon⁽⁸⁾.

Statistical analyses were performed with the aid of the Statistical Package for Social Sciences, version 17.0 for Windows (SPSS Inc.; Chicago, IL, USA). The descriptive analysis included absolute and relative frequencies. Continuous variables were expressed as mean and standard deviation, assuming a normal distribution.

RESULTS

A total of 529 breast MRI studies were included in the present study. The mean

patients' age was 49 years, ranging between 17 and 86 years.

Two hundred and nineteen women (41.4%) had a personal history related to increased risk for breast cancer, including previous breast cancer ($n = 125$; 23.6%), ovarian cancer ($n = 6$; 1.2%), breast surgery ($n = 201$; 38.1%), pre-malignant findings at percutaneous biopsy ($n = 13$; 2.5%) and history of thoracic irradiation ($n = 30$; 5.7%).

Family history of breast and/or ovarian cancer was present in 162 patients (30.6%), 110 (20.7%) of them in first-degree relatives.

Previous mammograms were available for 415 (78.4%) of the patients. The BI-RADS classification of mammographic findings is summarized on Table 1.

The most common indications for breast MRI were the following: inconclusive mammographic and/or US findings; evaluation of tumor recurrence/fibrotic scar tissue after breast surgery; and staging/surgical planning (Table 2). For 17 patients (3.2%) such information was not available.

In the group of patients whose indication for breast MRI was based on inconclu-

sive mammographic/US results, the most frequent findings were nodules in 114 out of 258 studies (44%), followed by architectural distortion in 59 (23%) and focal asymmetry also in 59 (23%).

DISCUSSION

Breast MRI is an expensive method, with potential false positive results and high frequency of incidental findings that may require further investigation. A thorough diagnostic evaluation with mammography and US must be undertaken before considering the necessity of MRI⁽⁹⁾. According to the recommendations of the European Society of Breast Cancer Specialists, breast MRI should be performed in radiological centers specialized in conventional breast imaging (mammography and US), percutaneous biopsy and MRI-directed second-look US⁽¹⁰⁾.

The most relevant factors in the interpretation of breast MRI studies are correlation with clinical data and conventional imaging results, as well as the presence of precise indications directing the investiga-

Table 1 Number of patients with mammograms classified according BI-RADS categories before breast MRI.

BI-RADS categories	Number of patients	(%)
1 – Negative	5	(0.9%)
2 – Benign findings	126	(23.8%)
3 – Probably benign findings	45	(8.5%)
4 – Suspicious abnormality	49	(9.3%)
5 – Highly suggestive of malignancy	14	(2.6%)
6 – Known biopsy – proven malignancy	28	(5.3%)
0 – Inconclusive findings	148	(28%)

Table 2 Frequency of indications for breast MRI.

Indications for breast MRI	N	(%)
Inconclusive findings at mammography and/or ultrasonography	258	(48.8%)
Evaluation of recurrent tumor/surgical scar after breast surgery	80	(15.1%)
Staging and surgical planning	62	(11.7%)
Screening of patients at high risk for breast cancer	45	(8.5%)
Evaluation of breast implants	23	(4.3%)
Evaluation before and/or after neoadjuvant chemotherapy	20	(3.8%)
Evaluation of occult primary tumor in patients with axillary metastasis	6	(1.1%)
Patient's desire	4	(0.8%)
Papillary discharge	3	(0.6%)
Paget's disease	2	(0.4%)
Other uncommon indications	4	(0.8%)
Unknown indication	17	(3.2%)

tion. In a multicentric study developed in the United States of America in 2008 interviewing 754 radiologists specialized in breast imaging, most of them (84%) answered that never (46.5%) or rarely (37.6%) interpret breast MRI studies without correlating their findings with mammographic/US findings. In this same study, the most common indications for breast MRI were aimed at evaluating the disease extent (93.8%) and clarifying inconclusive findings of conventional imaging methods (72.2%)⁽¹¹⁾.

The prevalence of personal and family antecedents related to breast cancer was high, which is expected in patients to be submitted to breast MRI, particularly in an oncology reference center. In the present study, the main indications for MRI are compatible with reports in the literature and international guidelines^(6,12). For about half of the patients in the present study, the indication for MRI was aimed at clarifying inconclusive findings of conventional imaging methods, followed by differentiation between tumor recurrence and surgical scar in previously treated patients, staging and preoperative planning in patients with confirmed diagnosis of cancer, besides screening of high-risk patients.

However, in spite of being the most common indication, there is no evidence in the literature justifying the utilization of breast MRI as a diagnostic tool in cases of inconclusive findings at conventional imaging studies, particularly those where percutaneous procedures can be performed^(10,13). The negative predictive value of MRI is not enough to avoid biopsy for a suspicious clinical or radiological finding without correspondence at MRI⁽¹⁴⁾.

A careful selection of patients with inconclusive mammographic findings requiring further evaluation with MRI is important. Moy et al. have evaluated 115 MRI studies performed with such an indication and observed that in 87% of cases, the method did not demonstrate any corresponding abnormality, and in only 0.7% malignant lesions were observed⁽⁹⁾. However, in selected cases, MRI may be utilized as a contribution to elucidate inconclusive mammographic/sonographic findings. Such cases include the differential diagnosis of cysts with echogenic contents at US,

focal asymmetry or architectural distortion without calcifications at mammography, mammographic findings observed at a single view, multiple nodular lesions of undefined etiology at mammography and US, and suspected tumor recurrence on surgical scar⁽¹³⁾.

In the literature, breast evaluation in the postoperative period is the most grounded indication for MRI, since surgery and/or radiotherapy may cause skin thickening, edema, development of masses, scars and architectural distortion. Such findings are hardly elucidated by mammography and US, possibly leading to unnecessary procedures. In such cases, the patients may benefit from breast MRI due the typical paramagnetic contrast uptake by the different breast tissues⁽¹⁵⁾. The presence of a non-contrast enhanced scar at MRI has a high negative predictive value for cancer recurrence. However, a normal increase in the vascularization may be observed in the surgical site up to 18 months following radiotherapy⁽¹⁶⁾.

Several authors have also described the relevance of breast MRI in the preoperative staging, considering that such method is more sensitive than conventional imaging methods to evaluate the tumor extent, even in cases of ductal carcinoma in situ and invasive lobular carcinoma⁽¹⁵⁾. Additionally, MRI is highly sensitive in the detection of multifocal, multicentric and contralateral tumors⁽¹⁷⁾. MRI can detect additional tumors in the same breast in 15–27% of patients, and in the contralateral breast in 3–10% of patients. The preoperative evaluation by MRI leads to change in the treatment in up to one third of breast cancer patients⁽¹⁸⁾.

For breast cancer screening, the American Cancer Society recommends annual MRI in association with mammography for patients with BRCA mutation or with first-degree relatives with such a mutation; patients under the risk = 20–25% of developing breast cancer based on risk evaluation tools; women with history of thoracic irradiation between 10 and 30 years; and patients with genetic disorders leading to increased risk for breast cancer, such as Li-Fraumeni, Cowden or Bannayan-Riley-Ruvulcaba syndromes⁽¹⁹⁾. On the other hand, there is not sufficient evidence to recom-

mend MRI for women under a risk of 15–20% for developing breast cancer during their lifetime; for women with lobular carcinoma in situ or atypical ductal/lobular hyperplasia; for women with heterogeneous or extremely dense breasts at mammography or those with breast cancer antecedents, including ductal carcinoma in situ⁽¹⁹⁾.

Other less common indications for breast MRI mentioned in the present study were the following: breast implants evaluation, patients submitted to neoadjuvant chemotherapy, and presence of primary occult tumor in patients with ganglionic metastasis. In cases of breast implants evaluation, MRI should be indicated to confirm or rule out implant rupture only in symptomatic patients whose conventional imaging methods could not detect any abnormality⁽¹⁰⁾. Neoadjuvant chemotherapy is routinely utilized in cases of advanced breast cancer to reduce the size of the tumor and, in some cases, to allow treatment with conservative surgery. MRI has demonstrated to be better than clinical examination, mammography and US to evaluate residual disease after neoadjuvant chemotherapy, contributing for a better surgical planning in such cases^(20–22). Occult tumors at conventional imaging studies of women with isolated metastasis to axillary lymph nodes represent < 1% of cases of breast carcinoma. MRI can identify the primary tumor in 62–86% of such cases⁽¹³⁾.

Finally, it is important to be aware of the appropriate indication for breast MRI. Considering that such method presents high sensitivity and high rate of false positive results, it should be recommended only in cases where there is a specific question to be answered, avoiding unnecessary procedures such as biopsies and follow-up studies. If appropriately indicated, breast MRI can significantly contribute in the diagnostic process, constituting an essential tool in the imaging evaluation of the breast.

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