

How Does MR Imaging Help Care for My Breast Cancer Patient? Perspective of a Surgical Oncologist

Benjamin Raber, MD^a, Vivian J. Bea, MD^b,
Isabelle Bedrosian, MD^{b,*}

KEYWORDS

• MR imaging • Breast cancer • Surgical oncology • Breast imaging

KEY POINTS

- Breast MR imaging has superior ability to detect breast cancer when compared with traditional mammogram, and is better able to define the extent of breast disease when compared with mammography.
- Although this improved local staging alters surgical therapy in a substantial number of patients, there is no evidence to date that there is longer term benefit, such as reduction in local recurrence or reduction in contralateral breast cancer rates.
- The disadvantages associated with breast MR imaging include low specificity, increased cost, increased negative biopsy rate, and increased patient anxiety associated with increased biopsy rate.
- Given the lack of demonstrable benefit in improving patient outcomes by breast MR imaging, there are current clinical trials studying its use in neoadjuvant breast cancer treatment, surveillance, screening, and impact on patient outcomes.
- Routine use of breast MR imaging is recommended for detecting underlying carcinoma in Paget disease, identifying occult primary breast cancer in patients presenting with axillary disease, and in screening high-risk populations.

INTRODUCTION

In the late 1980s, it was determined that contrast-enhanced MR imaging could distinguish benign from malignant breast tissue.^{1,2} Over time, the spatial and temporal resolution of MR imaging has increased, as the cost has decreased.^{3,4} MR imaging is now readily available for surgeons to incorporate into their practice, thus, begging

the question, is this new modality clinically useful? In its evolution, breast MR imaging has undergone multiple phases of recommendations, praises, and criticisms. This article discusses the current evidence-based consensus on where MR imaging belongs in a surgeon's arsenal, including the positive and negative implications of this technology.

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^a Department of Surgery, Baylor University Medical Center, 3500 Gaston Avenue, Dallas, TX 75246, USA;

^b Department of Breast Surgical Oncology, The University of Texas MD Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, TX 77030, USA

* Corresponding author.

E-mail address: ibedrosian@mdanderson.org

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MR Imaging Sensitivity

It is clear that MR imaging is superior to mammogram (MMG) in the detection of disease. This difference has been proven with numerous studies, which are summarized in **Table 1**. Large single-center studies have found the sensitivity of MR imaging for the detection of breast cancer to be from 88% to 99%, with sensitivities uniformly approaching 99% when MR imaging is combined with MMG.^{5–11} In 2004, Bluemke and colleagues¹² demonstrated that “additional lesions seen by MR imaging that are not visible on the MMG have been reported to be present in 27% to 37% of patients.” Given the improved local staging afforded by MR imaging, it becomes critical for the surgeon to determine where this highly sensitive diagnostic tool finds its best clinical application. We review various clinical scenarios and detail the evidence for use of MR imaging in these contexts.

USE OF MR IMAGING IN PATIENTS WITH CANCER

Staging of the Primary Tumor

An early concept considered in the implementation of MR imaging to breast cancer management was the ability of MR imaging to better define the extent of disease. It was believed that the increased sensitivity of MR imaging in detecting malignant breast tissue, as previously demonstrated, would better guide surgeons in determining proper resection margins, improve the selection of patients for breast-conserving surgery versus mastectomy, and consequently decrease the rate of reoperation. Retrospective series have consistently reported on the change in surgical therapy from breast-conserving surgery to mastectomy as a result of MR staging of disease

extent, and a meta-analysis of 19 studies by Housami and colleagues⁴⁵ noted that additional multifocal and/or multicentric disease identified by MR imaging resulted in a change in surgical therapy to mastectomy in one in six women.

Whether such a change in therapy results in reduced rates of reoperation was tested in the Comparative Effectiveness of MR imaging in Breast Cancer (COMICE) trial.¹³ The COMICE trial, published in *Lancet* in 2010, prospectively randomized 1623 women with biopsy-proven breast cancer to undergo either preoperative MR imaging, or no further imaging after initial diagnosis using physical examination, MMG, and ultrasound. Surprisingly, the addition of preoperative MR imaging did not decrease the rate of reoperation. In fact, exactly 19% of the control arm and of the MR imaging arm required reoperation to obtain acceptable margins after the initial excision.¹³ This trial only examined patients who were already determined to undergo breast-conservation therapy; therefore, we are unable to apply this outcome to the ability of MR imaging to prevent pathologically unnecessary mastectomy.

A second critical question is whether or not local control is improved by using the improved staging of breast MR imaging to resect mammographically occult areas of cancer. A large retrospective review from the University of Pennsylvania examined outcomes of women who underwent MR imaging before breast-conserving surgery versus patients who underwent breast surgery with no further imaging. Their results demonstrated no difference in the 8-year rates of local failure, no difference in 8-year overall survival, no difference in absence of distant metastases, and no difference on contralateral breast cancer occurrence.¹⁴ The data were also striking for the low rates of local recurrence across the cohort; 3% in the MR

Table 1
Sensitivity and specificity of MR imaging versus MMG

	MMG Sn (%)	MMG Sp (%)	MR Imaging Sn (%)	MR Imaging Sp (%)	MR Imaging + MMG Sn (%)	MR Imaging + MMG Sp (%)
Boné et al, ⁵ 1997	89.0	72.0	92.0	72.0	99.0	55.0
Kacl et al, ⁶ 1998	82.0	64.0	92.0	76.0	95.0	52.0
Malur et al, ⁷ 2001	83.0	68.5	94.0	68.5	98.0	90.0
Kristoffersen Wiberg et al, ⁸ 2002	84.0	59.0	94.0	47.0	99.0	19.0
Teifke et al, ⁹ 2002	73.7	65.2	88.4	59.4	95.5	47.1
Drew et al, ¹⁰ 1999	87.6	86.4	99.2	91.0	—	—
Boné et al, ¹¹ 2003	85	59	94	47	—	—

Abbreviations: Sn, sensitivity; Sp, specificity.

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