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Breast MRI:
A Guide for Referring Physicians

Opening New Doors for Evaluation and Treatment

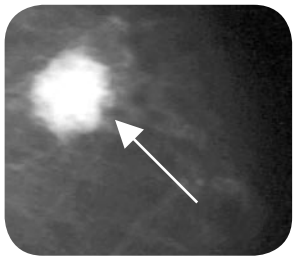
Breast Cancer: The Sobering Statistics

Consider the following facts about breast cancer:

- **Women who live in North America have the highest risk of breast cancer in the world.**
- **The American Cancer Society estimates that in 2008 about 182,460 new cases of invasive breast cancer will be diagnosed in the United States alone.**[1]
- **Breast cancer is the second-most common cancer affecting American women, surpassed only by skin cancer.**
- **Breast cancer is the second-most common cause of cancer death among women, surpassed only by lung cancer.**

Given what's at stake, it is imperative that physicians utilize the best available diagnostic tools to ensure early diagnosis and effective treatment.

Breast MRI's Emerging Role in Cancer Diagnosis



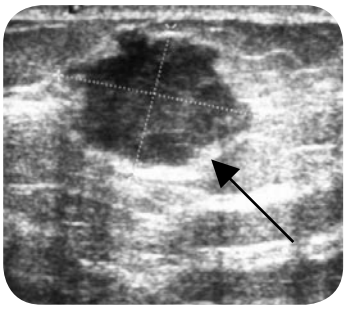
Mammogram showing dense, irregular spiculated mass (arrow).

Magnetic resonance imaging (MRI) has opened new doors for the evaluation and treatment of breast cancer. So how can MRI be worked into a diagnostic algorithm that for decades has relied only on physical examination, mammography, and ultrasound?

For a long time, **mammography** and **ultrasound** have been the diagnostic mainstays of breast evaluation. Mammography also has been an invaluable tool in the fight against breast cancer, reducing the mortality rate anywhere from 28 percent to 65 percent.[2] It is widely available, relatively inexpensive, and fast – making it a good test for screening purposes.

However, it does have its drawbacks:

- Mammography exposes the patient's breasts to a small amount of radiation.
- Mammograms also suffer from a relative lack of sensitivity, particularly in women under the age of 50 and those with dense breasts.
- The sensitivity of mammography, which is about 98 percent in fatty breasts, decreases to only 64 percent in dense breasts.
- In women over 50 years of age, a sensitivity of 83 percent was measured for all breast densities, decreasing to 58 percent for women under 50.[3]



Breast ultrasound showing a 19×14mm hypoechoic mass (arrow).

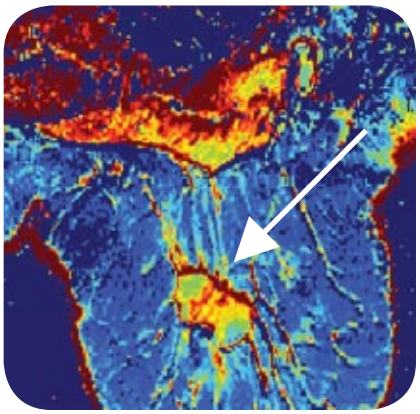
- Moreover, the low positive predictive value of mammography (36 percent) leads to many false negative examination results, unnecessary biopsies, and added anxiety for patients.

Ultrasound of the breast provides a real-time examination without any radiation, making it ideally suited for evaluating known or palpable breast masses. Its use in screening has been highly questionable, however, and ultrasound has limited usefulness in women with dense breasts. Moreover, its dependence on the skill of the technologist can make ultrasound an unreliable examination.

A woman's lifetime risk of developing invasive breast cancer is about 1 in 8.

How Does Breast MRI Work?

MRI is an imaging modality that uses a microwave and a magnet to estimate the distribution of fat and water in the breast. **Because it is not density-dependent and emits no radiation, this type of exam is well-suited for use with the breast.**



CAD Color Map MRI

During the examination the patient lies face-down on the MRI table. First, pre-contrast images are obtained. Next, a gadolinium contrast agent is administered and the breast imaged every minute or so to see the "angiogenesis," or vascular behavior, of the tumor.

The sequential contrast-enhanced images allow the radiologist to analyze the rate of peak enhancement and "wash-out." In other words, how fast does the mass take in the contrast and how fast does it release it? These factors are central in distinguishing benign from malignant tumors. Because of angiogenesis and leaky vessels, malignant breast tumors take in a great deal of contrast very quickly; they also release it very quickly. In benign masses the opposite effect is observed: the contrast is taken up gradually and consistently for several minutes.

A computer-aided detection, or CAD, system can aid the radiologist in localizing the areas that take in more contrast more quickly, using an automated process that creates color-coded maps of the areas of enhancement (see above right).

Integrating Breast MRI into the Diagnostic Algorithm

As we've seen, breast MRI is a powerful diagnostic tool and its role in breast imaging is steadily expanding. Today its use is indicated in five clinical situations:

1. **Screening high-risk women**
2. **Evaluating indeterminate cases, especially with dense- or small-breasted women**
3. **Preoperative staging**
4. **Evaluating response to treatment, especially to allow for lumpectomy rather than mastectomy**
5. **Screening and evaluation of women with cancer symptoms and breast implants**

Breast MRI's Role in Cancer Screening

Breast MRI has unquestionable value in screening women at high risk for breast cancer. In several studies, the sensitivity of breast MRI for invasive cancer actually has approached 100 percent,[2] proving to be a dramatically more effective tool than mammography for screening this population. In high-risk women, mammography has a sensitivity of only 20 percent for ductal carcinoma *in situ* (DCIS) and 26 percent for invasive cancer, compared to MRI's sensitivity of 87 percent for DCIS and 90 percent for invasive cancer.[4]

The research on this topic recently prompted the American Cancer Society (ACS) to revise its screening guidelines to include breast MRI for high-risk women (see table below). The ACS now recommends screening breast MRIs for all women who have:

- **A lifetime breast cancer risk of 20 to 25% or greater**
- **A strong family history of breast or ovarian cancer**
- **A history of treatment for Hodgkin's disease**
- **Undergone multiple scoliosis surveys as children (in some cases)**

Subtracted contrast-enhanced axial image shows multiple small enhancing masses in the anterior right breast (arrow). This represents multifocal cancer found in a patient with known right breast cancer.

American Cancer Society Recommendations for Breast MRI Screening as an Adjunct to Mammography[5]

- **Recommend annual MRI screening (based on evidence):**
  - Tested positive for BRCA gene mutation
  - First-degree relative of BRCA gene mutation carrier, but untested
  - Lifetime risk of 20 to 25% or greater, as defined by BRCAPRO or other models that are largely dependent on family history
- **Recommend annual MRI screening (based on expert consensus opinion):**
  - Radiation exposure to chest between ages 10 and 30 (such as scoliosis surveys)
  - Li-Fraumeni syndrome and first-degree relatives of people with the syndrome
  - Cowden and Bannayan-Riley-Ruvalcaba syndromes and first-degree relatives
- **Insufficient evidence to recommend for or against MRI screening:**
  - Lifetime risk of 15 to 20%, as defined by BRCAPRO or other models that are largely dependent on family history
  - Lobular carcinoma *in situ* (LCIS) or atypical lobular hyperplasia (ALH)
  - Atypical ductal hyperplasia (ADH)
  - Heterogeneously or extremely dense breast on mammography
  - Women with a personal history of breast cancer, including ductal carcinoma *in situ* (DCIS)
- **Recommend against MRI screening (based on expert consensus opinion)**
  - Women with less than 15% lifetime risk

The false-positive rate of breast MRI has been cited as a concern by many clinicians. Studies have shown that, as criteria are refined and experience is gained, the specificity of breast MRI has increased significantly over the past several years. Today it ranges between 75 and 92 percent.[6] The false-positive rate is highly variable between studies, with many as low as 4 to 5 percent and others measuring 23 to 24 percent.[6]

However, with the increasing use and availability of MRI-guided breast biopsy, those lesions seen only on MRI can be biopsied to identify the false positives, rather than resulting in unnecessary open biopsies or unjustified changes in surgical intervention. At ProScan Reading Services, the radiologists' combined experience of reading more than 10,000 breast MRI cases has helped to reduce our patients' biopsy frequency by 25 percent.

Preoperative Evaluation of Women with Newly Diagnosed Breast Cancer

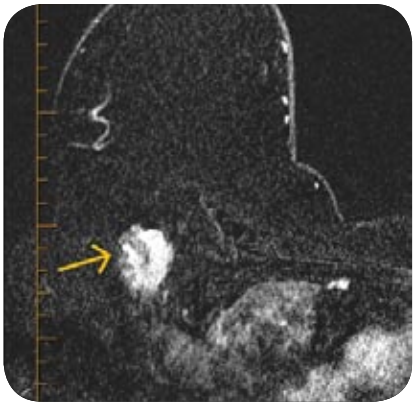
Breast MRI has tremendous potential to curb recurrence rates when used preoperatively. In one recent study, for example, a comparison was made between a group of 121 women with breast cancer who had preoperative MRI and 225 women with breast cancer without preoperative MRI.

At follow-up exams approximately 40 months later, the group without preoperative MRI had an in-breast recurrence rate of 6.5 percent and contralateral follow-up cancers in 4 percent. In contrast, the percentages for the group who had preoperative breast MRI were 1.2 percent and 1.7 percent, respectively.[6]

This not only establishes that breast MRI can curb recurrences, but also suggests that what is traditionally considered to be "in-breast recurrence" is not likely a recurrence, but rather unrecognized foci of cancer that were synchronous with the index tumor.[7]

The roles of preoperative breast MRI include:

- **Assessment of index tumor size**
- **Detection of synchronous breast cancers in the contralateral breast**
- **Detection of multifocal or multicentric disease in the ipsilateral breast**
- **Evaluation of response to chemotherapy**



Contrast-enhanced subtracted axial image shows large enhancing metastatic right axillary lymph node (arrow).

Monitoring Tumor Response to Treatment

Breast MRI also has high specificity in evaluation of tumor response to neoadjuvant chemotherapy. Traditionally, index tumor size changes after chemotherapy have been measured using clinical examination, ultrasound, or mammography. Unfortunately, these modalities suffer from a lack of sensitivity, often overestimating the amount of residual disease, and not showing changes in size until several cycles of chemotherapy have been completed.[8]

Several studies have highlighted the accuracy and sensitivity of breast MRI in this situation, allowing more objective and precise measurement of tumor response using the RECIST (**R**esponse **E**valuation **C**riteria **I**n **S**olid **T**umors) criteria. For example, one study demonstrated that MRI could accurately identify patients who had no response to chemotherapy with a sensitivity of 100 percent and specificity of 85 percent after one cycle of chemotherapy, and 90 percent after two cycles.[8] Determination of response is based mainly on size criteria, in conjunction with alterations in dynamic contrast enhancement. Response to treatment can also be used to determine if a patient is a candidate for a lumpectomy.

Sagittal inversion recovery water-saturated sequences shows a silicone implant with the "linguine sign" (arrow) indicating intracapsular rupture.

Using MRI in Patients with Breast Implants

More than one million American women have breast implants today. Possible complications may include leakage, rupture, infection, fibrosis, and contraction. Although mammography has been traditionally used to detect extracapsular rupture, it is insensitive to small leaks and intracapsular ruptures. The sensitivity and specificity of MRI for implant rupture were measured to be 76 percent and 97 percent in one study.[9]

The ability of MRI to detect carcinomas in women with breast implants is also extremely important. Mammography in women with implants is performed using modified compression imaging, which can increase the radiation dose and, in rare cases, may even rupture the implant. **Even with these techniques, it is estimated that silicone implants obscure from 22 to 83 percent of breast tissue on mammography.[9]** Because of its cross-sectional nature, MRI does not suffer from this limitation in patients with implants.

Summary:
When Should Breast MRI Be Used?

- **High-risk screening, especially in women over age 50**
  MRI is useful as an adjunct to mammography in women at high risk, those with dense breasts, and evaluation for recurrence in women with history of high-grade cancer.
- **Indeterminate cases**
  MRI is also useful in clarifying findings that are equivocal or disparate on physical exam, mammography, and/or ultrasound.
- **Dense-breasted women**
- **Preoperative evaluation and staging**
  MRI is accurate at detecting index tumor size, ipsilateral and contralateral synchronous cancers, metastases, and chest-wall infiltration.
- **Response to chemotherapy**
  MRI is helpful in measuring a tumor's reponse to chemotherapy and determining who can undergo a lumpectomy.
- **Implants**
  – Evaluation for complications, such as rupture or infection
  – Screening for cancer

Reimbursement for Breast MRI

Medicare and most other commercial health insurers reimburse for breast MRI services when medically necessary; some insurers require authorization prior to examination. The following **C**urrent **P**rocedural **T**echnology (CPT) code must appear on the patient's prescription and should be reported to the insurer when obtaining authorization:

77059 – Bilateral Breast, With or Without Contrast

An additional CPT code (**0159T – Breast MRI Computer-Aided Detection**), used to report analysis with CAD, may be included with a patient's examination. This code is only reported if the radiologist determines that CAD analysis would be useful for a patient's examination. It is unnecessary to report this code during the prior authorization process.

Note: Although there is a CPT code for unilateral breast imaging, our imaging protocol includes both breasts when evaluating for cancer.

Because breast MRI is used only for diagnostic purposes, and to screen patients at high risk for developing breast cancer, reimbursement for this examination is rarely denied by insurers. The following **I**nternational **C**lassification of **D**iseases (ICD-9) codes are often reported in conjunction with breast MRI. These codes may be useful in describing the clinical indications for your patient's examination to health insurers:

611.71 Pain in breast
611.72 Lump/mass in breast
611.8 Other specified breast disorder
611.9 Unspecified breast disorder
611.79 Symptoms breast discharge – other
174.9 Cancer breast
238.3 Breast neoplasm/uncertain behavior
610.0 Fibrocystic breast disease
610.1 Cystic breast
611.1 Hypertrophy breast
611.0 Inflammation disease of breast

Out-of-Pocket Patient Expenses

Although breast MRI is nearly always covered by insurance, most patients have at least some minimal co-insurance requirement. Breast MRI is an expensive examination and fee schedules can vary from provider to provider by hundreds of dollars for the same examination. Hospitals are typically the most expensive site of service for MRI examinations. What's more, patients often receive separate bills from the hospital and the interpreting radiologist, leading to confusion and increased expense. Choosing the right facility for these services potentially can save your patient hundreds of dollars in out-of-pocket expense.

Selecting a Breast MRI Provider

Not every MRI facility is equipped to provide breast MRI services, and not every radiologist is qualified to render the specialized interpretations needed to make accurate use of this powerful tool. When referring your patients for breast MRI, we believe you should know the following:

- ***Are other breast imaging modalities available?***

  Breast MRI is not necessarily a replacement for other breast imaging modalities, and in most cases is used in conjunction with mammography. Prior mammography may be necessary for comparison and may be easily obtained if the breast MRI provider did not perform these services initially. It is not necessary for a high-quality provider of breast MRI services to offer additional breast imaging modalities.

- ***Does the radiologist have adequate experience in breast MRI interpretation?***

  Breast MRI examinations are highly complex; the interpreter must review as many as 2,500 images per case, evaluating the anatomical features and structure of the breast, as well as the enhancing characteristics of the lesion that help differentiate between malignant and benign conditions. Our radiologists, in partnership with **ProScan Reading Services**, have read more than 10,000 breast MRI cases. **The experience level of the interpreter largely determines how sensitive and specific the examination will be — and most importantly, the likelihood your patient will experience a false-positive finding and unnecessary biopsy.**

*Source: *New England Journal of Medicine*, March 29, 2007

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