

# Breast MRI Imaging



**Advanced  
Diagnosis  
and Staging**



**Medical Arts Radiology**

*Imaging Excellence on Long Island for over 70 Years*

# MR Imaging of the Breast: Advanced Diagnosis and Staging

**M**ore than 275,000 women in the United States will receive a diagnosis of breast cancer this year, and over 40,000 women will die of the disease. Breast cancer mortality is second only to that of lung cancer and for women ages 40-55 it is the leading cause of death. Randomized trials have shown that the use of screening mammography in the general population reduces mortality associated with breast cancer by at least 24 percent. Yet many challenges remain to improve detection and guide appropriate therapy. Mammography may miss 15-20% of cancers, particularly in patients with dense fibroglandular tissue which may obscure an underlying tumor. Additional challenges for breast imaging include: early detection in high risk patients such as those with lobular carcinoma in situ (LCIS) or BRCA1 and BRCA2 genetic markers; assessment of surgical margins; and appropriate selection of patients for lumpectomy or mastectomy depending on histology and local staging.

Today, breast MRI has emerged as an extremely helpful imaging tool in evaluating mammogram abnormalities and identifying early breast cancer, especially in women at high risk. The sensitivity for breast MRI in the detection of invasive breast cancer is extremely high, greater than 90% in most studies. There is greater variability in the sensitivity in the detection DCIS which is probably in the 50% range.

The main strengths of MRI include its exquisite delineation of soft tissue and its ability to image the breast in fine sections dynamically and in multiple planes thereby providing four-dimensional information. The basis of MR enhancement of breast cancer relates to invasive tumor angiogenesis. Invasive breast cancer shows increased vascularity with increased vessel permeability leading to early contrast uptake and early washout phenomena. MR image interpretation is based upon the evaluation of enhancement kinetics or patterns of contrast enhancement as well as evaluation of lesion morphology or architectural features on high spatial resolution images.

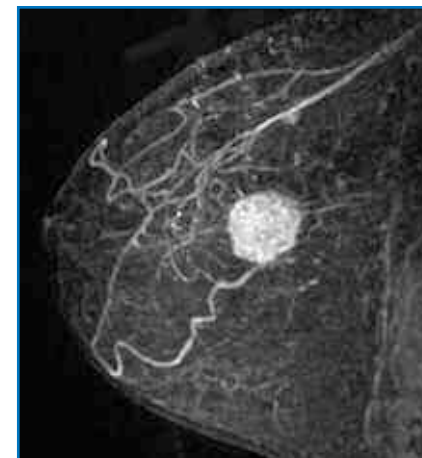
Although there is universal agreement that breast MRI is an extremely sensitive imaging technique for the detection of breast cancer, MRI does not replace screening mammography. Instead it provides a powerful supplementary tool for detecting and staging breast cancer.

*All cases presented in this brochure were performed at Medical Arts Radiology.*

## Current Clinical Indications for Breast MRI

### DIAGNOSIS

- ❖ **Lesion characterization:** Breast MRI may be indicated when other imaging examinations, such as ultrasound and mammography, and physical examination are inconclusive for the presence of breast cancer. Other conditions that may impair conventional breast imaging, such as silicone augmentation or radiographically dense breasts, may warrant breast MRI depending on the clinical findings.
- ❖ **Contralateral breast examination in patients with breast malignancy:** MRI can detect unsuspected disease in the contralateral breast in at least 4% - 5% of breast cancer patients. This is often in the face of negative findings on mammography and physical examination.
- ❖ **Scar versus tumor:** Breast MRI may be helpful in patients who have had previous surgery for breast cancer, to distinguish between postoperative scarring and recurrent cancer.
- ❖ **Axillary adenopathy, primary unknown:** MRI may be indicated in patients presenting with axillary adenopathy and no mammographic or physical findings of primary breast carcinoma. In patients with breast cancer, breast MRI can locate the primary tumor and define the disease extent for definitive therapy. A negative breast MRI may exclude the breast as a potential primary site of cancer and avoid a mastectomy that would provide no treatment benefit.
- ❖ **Recurrence of breast cancer:** Breast MRI may be indicated in women with a prior history of breast cancer and suspicion of recurrence when clinical and/or mammographic findings are inconclusive.



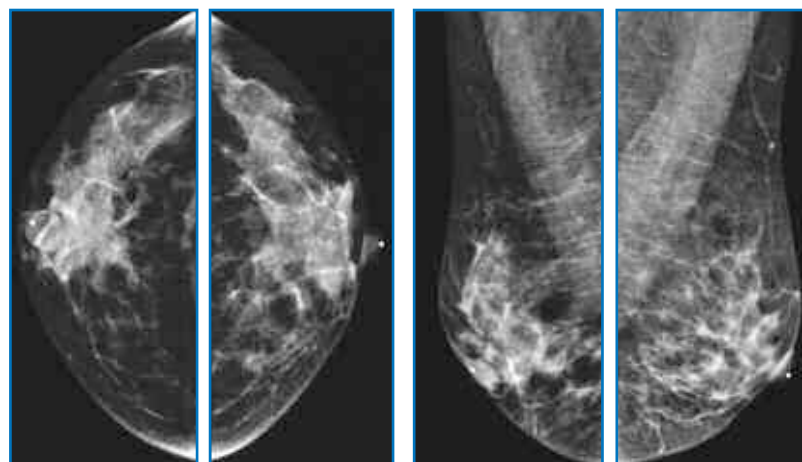
- ❖ **Silicone and nonsilicone breast augmentation:** Breast MRI is useful in the evaluation of patients with silicone implants and/or injections in whom mammography is difficult, and in patients with nonsilicone implants. In these settings, breast MRI may be helpful in the diagnosis of breast cancer and in the evaluation of implant integrity and rupture.

## STAGING

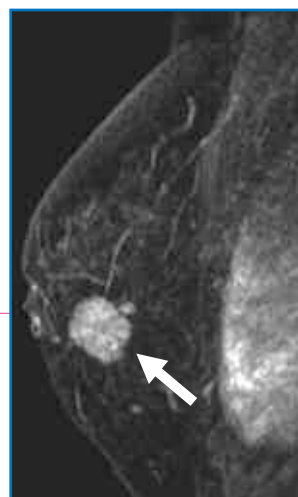
- ❖ **Infiltrating lobular carcinoma:** Physical examination, mammography, and ultrasound may be limited in the evaluation of infiltrating lobular carcinoma. Breast MRI may be indicated for evaluation of extent, multifocality, and multicentricity.
- ❖ **Infiltrating ductal carcinoma:** Breast MRI may be indicated in order to determine the extent of disease, particularly in breast conservation candidates. MRI determines the extent of disease more accurately than standard mammography and physical examination in many patients.
- ❖ **Invasion deep to fascia:** MRI evaluation of breast carcinoma prior to surgical treatment may be indicated in both mastectomy and breast conservation candidates to define the relationship to the fascia, extension into pectoralis major, or extension into serratus anterior and intercostal muscles.

## SCREENING

- ❖ **Surveillance of high-risk patients:** Recent clinical trials have demonstrated that breast MRI can significantly improve the detection of cancer that is otherwise clinically and mammographically occult. Breast MRI may be indicated in the surveillance of women with a genetic predisposition to breast cancer (BRCA1, BRCA2), or in patients with a family/personal history suggesting risk equivalent to that of BRCA1/2.



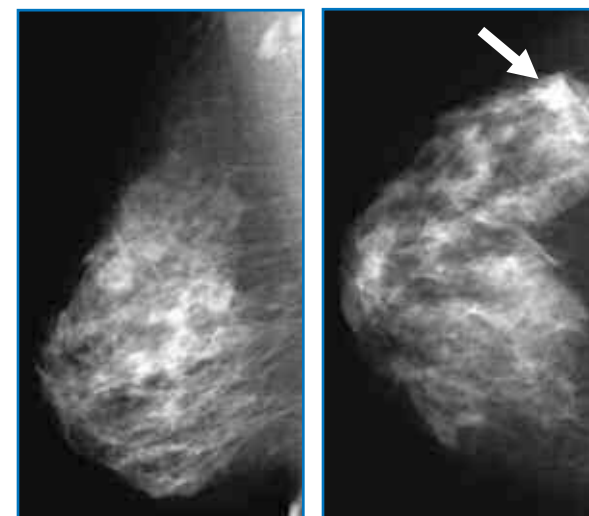
*Example of improved sensitivity of MR over conventional mammography for the detection of invasive breast cancer. Bilateral CC and MLO views from mammogram appear normal with no suspicious findings.*



*Left breast MRI in same patient reveals early, intense enhancement within a 2cm indistinctly marginated irregular mass (arrow) in the retroareolar region. Biopsy confirmed infiltrating ductal carcinoma.*

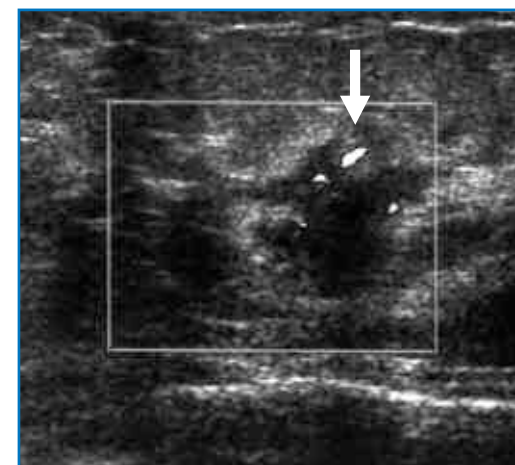
## MANAGEMENT

- ❖ **Neoadjuvant chemotherapy:** Breast MRI may be employed before, during, and/or after a course of chemotherapy to evaluate chemotherapeutic response and the extent of residual disease prior to surgical treatment. MRI-compatible localization tissue markers placed prior to neoadjuvant chemotherapy may be helpful in the event of complete response with no detectable residual tumor for resection.
- ❖ **Postlumpectomy for residual disease:** Breast MRI may be used in the evaluation of residual disease in patients who have not had preoperative MRI and whose pathology specimens demonstrate close or positive margins for residual disease. MRI can evaluate for multifocality and multicentricity to help determine which patients could be effectively treated by re-excision or whether a mastectomy is required due to the presence of more extensive disease.

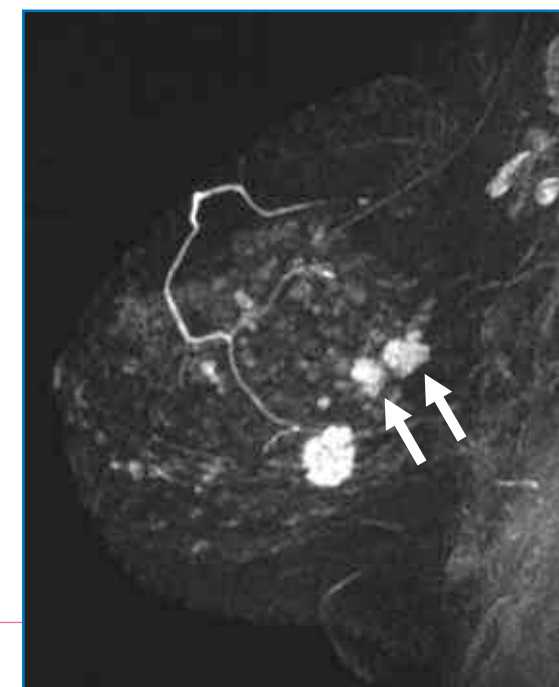


- ❖ **Postoperative tissue reconstruction:** Breast MRI may be indicated in the evaluation of suspected cancer recurrence in patients with tissue transfer flaps (rectus, latissimus dorsi, and gluteal) or implants.

*Value of breast MRI in staging of breast carcinoma. Right mammogram depicts a single mass in the lateral aspect of the breast on CC view (arrow), not well localized on MLO projection.*



*Ultrasound of same patient shows a corresponding irregular mass with angular, spiculated margins and increased vascularity (arrow). However, breast MRI demonstrates the presence of multicentric carcinoma with two additional lesions in the breast more posteriorly (arrows).*



## Contraindications and Patient Preparation

As with any MRI exam, possible contraindications may include, but are not limited to, the presence of cardiac pacemakers, ferromagnetic intracranial aneurysm clips, certain neurostimulators, certain cochlear implants, and certain other ferromagnetic implants, devices, foreign bodies, or electronic devices.

Increased parenchymal enhancement has been observed normally during the secretory phase of the menstrual cycle. This normal enhancement can give rise to false positive MRI scans. It is therefore recommended that breast MRI scans be performed during the second menstrual week whenever possible. Bilateral imaging may help to improve specificity, as enhancement characteristics vary from patient to patient and during the menstrual cycle, and enhancement of some benign conditions such as fibrocystic changes is often bilateral.

## Diagnostic and Therapeutic Controversies

Current controversies surrounding breast MRI include the potential for detection of additional abnormalities other than the initial clinically or mammographically detected lesion. These MRI-detected, clinically and mammographically occult lesions may or may not be clinically significant.

Patients being considered for breast-conserving treatment may be converted to mastectomy based on MRI information. Caution should be exercised in changing management based on MRI findings alone, as most mammographically occult lesions are successfully treated with irradiation and/or chemotherapy following surgical removal of the known lesion.

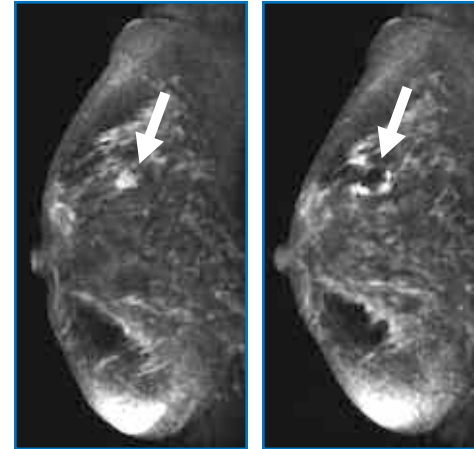
Additional biopsies or correlation with other clinical and imaging information should be used along with good clinical judgment. Clinical trials are needed to determine the outcome significance of MRI-detected, clinically occult disease.



## MR-Guided Biopsies and Wire Localizations

MR detects lesions that cannot be seen on ultrasound or mammography, so it is critical to localize or biopsy these lesions using that same technique. Sites performing breast MR should scan only if they are prepared to offer MR-guided localization or biopsy of suspicious findings. Medical Arts Radiology has been at the forefront of breast MR imaging and is one of the few places on Long Island where physicians

are experienced with MR-guided interventions, including minimally invasive vacuum-assisted MR-guided biopsy. In addition, our facilities offer all conventional breast imaging technology including mammography, breast ultrasound, stereotactic biopsy, and ultrasound-guided biopsy.



**MRI-guided percutaneous biopsy.**  
Sagittal image reveals 12-mm irregular enhancing mass (arrow). Subsequent image during MRI-guided breast biopsy confirms biopsy cannula within lesion (dark signal void). Vacuum-assisted core needle biopsy revealed invasive ductal carcinoma.

## Medical Arts Radiology Expertise

MRI is an exceptional tool for breast cancer diagnosis and staging; however, this technology must be administered by experienced practitioners who understand its appropriate uses and limitations. Medical Arts Radiology has extensive experience in all facets of breast imaging and MRI. Accredited by the American College of Radiology, our radiologists, technologists, and specialized equipment offer state-of-the-art MRI exams. In addition, by correlating the patient's breast MRI with other studies including ultrasound and mammography, we are able to provide the most accurate diagnoses.

The breast MRI program at Medical Arts is supervised by Dr. Michael Shapiro, who has over a decade of experience in the application of MR techniques to breast imaging. Dr. Shapiro trained at the University of Pennsylvania, a world-wide leader in MRI, and further developed protocols in breast MRI while working at North Shore University Hospital in the late 1990's. At Medical Arts Radiology, Dr. Shapiro works closely with an integrated team of fellowship-trained radiologists who have extensive experience in breast imaging and minimally invasive breast biopsy procedures.



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