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**F**or many years now, mammography and, in some instances, sonography, has been the key tool for screening women for breast cancer. Often, however, the use of these modalities can lead to inconclusive findings, leaving imagers and patients at a loss for the next step in preventive screening. Now, many imagers are turning to MRI as an adjunct imaging method to detect possible breast cancer when previous exams are questionable or uncertain.

Linda Moy, a radiologist with the Breast Imaging Center at the Cancer Institute at the New York University School of Medicine in New York, and her colleagues tackled this subject in a recent study that was spotlighted in the October 2009 issue of the *AJR*. The study, "Is Breast MRI Helpful in the Evaluation of Inconclusive Mammographic Findings?" was designed to evaluate the usefulness of MRI of the breast in cases in which mammographic or sonographic findings are inconclusive. Moy recently agreed to offer an inside view of the study, its results, and what it means for breast imagers.

## **Q** *What spurred you to conduct this particular study?*

Our study examines the use of MRI in evaluating mammographic lesions that may represent subtle signs of breast cancer. Although we thought the mammographic findings were probably summation artifacts, we were unable to exclude an underlying mass with a high enough degree of certainty. Given its multiplanar capabilities and its good soft-tissue resolution, we detthought MRI would be well-suited as a problem-solving tool in this setting. This topic is clinically important because the role of MRI in clinical breast imaging continues to be defined. MRI is an expensive exam and has a relatively high frequency of detecting false-positives. These incidental lesions may need additional work up or biopsy. Correlation of MRI-detected findings with other imaging modalities can be challenging due to the differences in patient positioning during mammography, ultrasound (US), and MR examinations. Many authors have investigated MRI's role as an accessory to mammography and ultrasound in detecting occult malignancy and evaluating suspicious findings. However, there are few studies about equivocal findings. We thought the data addressing this question remain relatively sparse, and data using current MRI protocols were needed.

## **Q** *Did any of the results surprise you?*

As expected, we found MRI to be helpful as a detection method in cases in which the mammographic and sonographic findings were inconclusive. Our study suggests that for the subtle mammographic findings of asymmetries and architectural distortion, a negative MRI was reassuring. We were taken aback that MRI identified all cases of

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malignancy. Also, 40 percent of MR findings with a mammographic correlate proved to be malignant.

We were also astounded that the subtle mammographic finding was more difficult to localize in three dimensions in a background of dense breast tissue. In our series, most cases had dense breast tissue (Type III and Type IV). Fifty-nine of 81 (72.8 percent) women with dense breast tissue underwent an US examination. In this setting, the failure to visualize a lesion at sonography did not exclude the presence of a true mass. We found that MR (with its higher sensitivity in dense breast tissue compared to mammography and US) reinforced our assessment that the finding was a summation artifact and to not recommend a biopsy.

Most noteworthy was the high rate of incidental lesions, identified in 15.7 percent of MRI exams. These lesions required additional work-up. All lesions were false-positive and turned out to be benign in our study.

**Q** *What do the results of this study mean to the rank-and-file radiologist/breast imaging specialist in the field?*

We found the following results to be useful in the management of patients with inconclusive mammographic findings:

- For the vast majority of findings, additional evaluation with mammography and targeted US was sufficient to render a final management (routine follow-up, short interval follow-up, or biopsy). In our study, very few mammograms (<1 percent) were categorized to be inconclusive after a thorough work-up. Breast MR exams were infrequently (3.9 percent) performed to further evaluate an inconclusive mammogram.
- We concluded that few — only 0.7 percent — of the inconclusive findings on mammography proved to be malignant.
- We were unable to differentiate the roles of a complimentary US versus MRI examination in our study because US was not performed in all cases. No definite criteria were used to decide if US would be useful. US was performed at the discretion of the interpreting radiologist. Retrospective review found that an US was more likely to be performed when the precise three-dimensional location of a lesion is known. Sonography plays an important role when mammographic evaluation concludes a real lesion is present.

Sonography was performed in only 15 of 55 (27.3 percent) of one-view-*asymmetry*. It is very difficult to replicate on US the specific positioning and location of a lesion that is visible on one particular mammographic projection. We do not perform a diagnostic US of the entire breast in this setting. Therefore, uncertainty of the presence of a real lesion remained when the US examination was normal.

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Even when a sonographic lesion was identified, it was difficult to determine whether it was consistent with the mammographic finding. We had one case where sonography revealed a different lesion (fibroadenoma) and failed to identify the mammographic-detected cancer. After we performed this study, we instituted the following guideline in our practice: US should be performed if the location of a noncalcified mass is known. We could not reach a conclusion about the criteria for performing an US for findings seen on one-view-only. However, given the wide availability of US and its decreased cost, it is probably worthwhile to pursue a targeted US. Caution should be exercised, however, as a negative US may be over-reassuring.

*Are a majority of breast imagers around the country already using MRI as an adjunct scanning tool for breast cancer? Do you expect this use to increase in the years ahead as a result of studies like yours?*

Breast imagers around the country are already using MRI as an adjunct screening method in high-risk women. The American Cancer Society published guidelines in 2007 that recommended annual screening with breast MRI in a subset of high-risk women. They are also using this exam as an adjunct technique in women who have been newly diagnosed with breast cancer. MRI's role as a problem-solving modality is small but has increased in recent years. We expect that additional imaging with MR in this setting will increase as it becomes more widely available. In cases with a subtle finding on mammography, MRI was able to exclude the presence of a real mass.

However, we stress that a thorough work-up and possible biopsy be performed before using MRI. Although MRI is a less-invasive means, a percutaneous biopsy is less expensive than a MR examination. We believe that biopsies should be attempted when the location of a lesion is known. Although an attempted biopsy can be performed on one-view-only lesions, a level of uncertainty remains as to whether a true lesion exists and if it has been biopsied appropriately.

*You mention that MRI serves as a useful adjunct method to mammography for screening for breast cancer, but that it requires strict patient criteria. What type of criteria could/should be used to achieve these goals?*

We are performing follow-up studies investigating the reason (e.g., differences in k-space sampling strategies, fat suppression techniques) for the observed inconsistency in kinetic patterns. In addition, we are developing phantoms that can be used to perform quantitative standardization of breast DCE-MRI acquisitions. Results from such studies could help design and evaluate imaging protocols that yield robust kinetic evaluation of breast lesions across imaging systems and protocol. The role of MR as a problem-solving technology needs to be carefully selected because MR is an expensive exam with potential false-positives and the detection of incidental lesions.

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Also, MR will not negate a recommendation for biopsy. What we used are the following criteria:

- MRI should not be used in place of inadequate conventional work-up.
- The mammographic and sonographic work-up should be exhausted before resorting to MRI. Lesions that may be readily biopsied, e.g., palpable masses or microcalcifications, should not be further evaluated with MRI.
- We do not believe that MR has a role in evaluating a suspicious finding amenable to mammographic or sonographic localization for which the MR exam was performed solely to decide if a biopsy was needed.

Our data do not support further evaluation with MRI for all focal asymmetries and architectural distortion. For the vast majority of both findings, additional mammography and targeted US will conclude that the finding represents a summation artifact or a real lesion. Therefore, only the most vexing cases where the mammographic findings are subtle and the US was negative or may be inconsistent with the mammographic finding should undergo further evaluation with MR.

Therefore, the selection criteria would include a nonpalpable, noncalcified, mammographically-detected finding, despite a meticulous mammographic work-up and a targeted US, for which the presence of a real lesion cannot be ruled out. The lesions would include subtle findings seen on two views and a finding visible on one-view-only. Also, cases where benign biopsy results were obtained, but a level of uncertainty remains as to whether a true lesion exists, and the biopsy was done appropriately should also undergo further evaluation with MR.

*Do you expect to conduct any follow-up study to this one? If so, what would be the goal of that study?*

We are conducting follow-up studies because our study had several limitations. Our studied population was high risk, and additional evaluation with MR was performed to place them [patients] into a final BIRADS® category, and therefore, provide management guidelines. We are currently performing a prospective analysis of the adjunctive role of MR in the evaluation of equivocal mammographic findings in a high-risk population and in the general-risk group.

We are also studying the complimentary role of US and MRI in the evaluation of a subtle mammographic finding. In our follow-up study, a targeted US is performed when the anatomic location of an abnormality can be determined. If the exact location cannot be ascertained, US is performed in a larger area to search for a presumed lesion. We will attempt to establish criteria for when an US examination should be performed in this setting.

Finally, we will attempt more accurate categorization of these lesions detected on MRI, particularly the incidental ones. ■