1. Below are four unique findings (arrows, A-D) that were recommended to be biopsied on breast MRIs. Based on evidence, which finding is least likely to be visible on MRI-directed targeted ultrasound?

A. Irregular shaped mass with rim enhancement and spiculated margins
B. Linear non-mass enhancement distributed with homogeneous internal enhancement
C. Irregular shaped mass with rim enhancement and irregular margins
Rationale: While ultrasound-guided biopsy is less expensive, more readily available, and more comfortable for patients than MRI-guided biopsy, not all MRI-detected lesions are readily identified on ultrasound. A recent meta-analysis evaluating the sonographic visibility of MRI-detected findings demonstrated that slightly over one half of lesions have a correlate on MRI-directed (sometimes referred to as “second look”) ultrasound (range 22.6%-82.1%; pooled rate = 57.5%) (1, 2). Prior studies have demonstrated MRI features that correlate with a higher likelihood of having a sonographic correlate include larger size (>10 mm), mass morphology, deemed highly suspicious (BI-RADS category 5), or located within tissues such as the axilla (2-6). Conversely, MRI findings that are non-mass enhancement, are smaller, or located within heterogeneous breast tissue, or are located nearby small cysts or fibroadenomas are less likely to be confidently identified on ultrasound (6) (3, 4).

In this case, both “A” and “C” demonstrate masses that are larger in size, exhibiting highly suspicious morphologic features (BI-RADS category 5), and thus are very likely to be sonographically visible. In addition, morphologically abnormal axillary lymph nodes (answer choice “D”) are readily visible on ultrasound. However, smaller subtler non-mass enhancement lesions (e.g. linearly distributed non-mass enhancement, answer choice “B”) without associated masses or clumped internal enhancement are less likely to have a sonographic correlate.


DeMartini WB, Eby PR, Peacock S, Lehman CD. Utility of targeted sonography for breast lesions that were suspicious on MRI. American Journal of Roentgenology. 2009;192(4):1128-34.


2. A 29-year-old woman with a BRCA 1 mutation presented for screening MRI. Linear non-mass enhancement was identified in the left subareolar breast (blue arrows), and was assessed as BI-RADS category 4. A targeted ultrasound was performed, and no sonographic correlate was identified. What is the next appropriate step in management?
A. Perform MRI-guided biopsy
B. Perform MRI-guided wire localization and surgical excision
C. Downgrade assessment to probably benign (BI-RADS category 3) and perform 6 month follow-up MRI
D. Downgrade assessment to benign (BI-RADS category 3) and perform 12 month follow-up MRI

**Answer: A**

**Rationale:** The negative predictive value of ultrasound is not sufficient to obviate the need for MRI-guided biopsy when no sonographic correlate is found, as over 1 in 5 sonographically-occult MRI-detected lesions are malignant (1). As a result, a negative ultrasound in this case should not be used to downgrade the initial BI-RADS assessment on MRI. An MRI-guided wire localization and excision could provide diagnosis; however, it is not appropriate since this finding could represent a benign process and thus could result in an unnecessary surgery. Furthermore, by diagnosing a malignancy prior to surgery by means of core needle biopsy, a full treatment plan can be determined prior to surgery, lessening the risk of need for additional surgeries to obtain negative margins or lymph node staging and allowing the possibility for neoadjuvant therapies prior to surgery.

**Reference:** DeMartini WB, Eby PR, Peacock S, Lehman CD. Utility of targeted sonography for breast lesions that were suspicious on MRI. American Journal of Roentgenology. 2009;192(4):1128-34.

3. The image below illustrates a patient positioned for a lateral approach for an MRI-guided biopsy, targeting a lesion located at posterior depth. Which of the following is true when considering optimal positioning for biopsy?
A. Positioning the patient’s arms above her head as illustrated will allow for greater access to posterior tissue
B. Strong compression of the breast within the grid should be applied, similar to that used for stereotactic biopsies
C. Increasing the amount of padding under a patient's torso can be helpful to access the intended far posterior lesion
D. Pre-contrast images should be reviewed prior to administering contrast to ensure grid is positioned optimally so that the lesion may be sampled as planned

Answer: D

Rationale: When positioning a patient for MRI-guided biopsy, it is essential that patient comfort is maximized to reduce excessive patient movements and ensure a successful procedure. The patient should then be assisted into the prone position on the MRI table with the breasts deeply seated in the coil. Compression of the breast should be light to moderate; this is in contrast to stereotactic biopsies where motionless imaging of microcalcifications is needed. In addition, it is important to consider breast tissue perfusion (excessive compression can lead to non-visualization of a lesion) and patient discomfort (which can lead to patient inability to remain still) when determining the amount of compression needed to stabilize the breast.

Lesions that are far posterior require some additional considerations when positioning a patient. Some authors have found that positioning the arms down alongside the body (rather than the more common position of raising the arms above the head) can relax the pectoralis muscle and can allow for more breast tissue to fall dependently into the coil and thereby improve grid access (1). Other modifications for accessing posterior lesions include adjusting the position of the grid, removing excess padding under the torso, and oblique patient positioning. Regardless of how a patient is positioned and what approach is selected, it is important that the pre-contrast images be assessed carefully using landmarks to ensure that the area of expected enhancement will be accessible so that any potential adjustments can be made prior to injecting contrast.


4. A 72 year-old woman with a mammographic-screen detected left breast cancer (blue circle) presented for a breast MRI for staging. While no additional disease was identified in the left breast, a 5 mm round
mass with heterogeneous internal enhancement was identified in the contralateral right breast at 5 o’clock, lower inner quadrant (arrow). Targeted ultrasound of the right breast was negative. What should be considered when determining and performing the next appropriate procedure?

A. MRI-guided biopsy is not feasible due to small size of the mass and thus MRI-guided wire localization should be performed
B. MRI-guided biopsy is not feasible due to small size of the mass and thus a stereotactic-guided biopsy should be performed
C. A medial MRI-guided biopsy approach is likely to best allow access to this lesion given its slightly medial location
D. A lateral MRI-guided biopsy approach is likely to best allow access to this lesion given its posterior location

Answer: D

Rationale: Posterior lesions often require a lateral approach, even when the lesion is located medially. This is because the sternal bar on the coil is lower closer to the floor of the room than the lateral bar, which can substantially limit access to the most posterior boxes in a grid. In this case, the lesion is located at posterior depth and only slightly medially to the nipple. It is most likely, given the posterior depth, that a lateral approach will best allow access to this lesion.


5. 55 year-old woman at high-risk for breast cancer presents for a screening breast MRI. In the left breast at 2 o’clock, upper outer quadrant, 44 mm of segmental non-mass enhancement was noted with heterogeneous internal enhancement (yellow circles). An MRI guided biopsy was performed, with plastic
obturator tip (blue arrow) noted to be within the non-mass enhancement. Pathology revealed classic type lobular carcinoma in situ. What do you recommend next?

A. Pathology is benign and concordant. Recommend 6-12 month follow-up MRI.
B. Pathology is benign and discordant. Recommend mammographic-guided wire localization and excision.
C. Pathology is high-risk and concordant. Recommend 6-12 month follow-up MRI.
D. Pathology is high-risk and concordant. Recommend mammographic-guided wire localization and excision.

Answer: D

Rationale: Most lesions presenting as non-mass enhancement (NME) require needle sampling due to wide overlap in MRI appearance of benign and malignant pathologies presenting as NME. Although the majority of biopsies prompted by breast MRI result in an unequivocal diagnosis of benign or malignant pathology, as many as 21% are classified as “high-risk” on histopathologic assessment (1). High-risk lesions represent a spectrum of nonmalignant breast pathology, including atypical ductal hyperplasia, lobular carcinoma in situ, atypical lobular hyperplasia, radial scar/complex sclerosing lesions, and papillary lesions. The term “high-risk” refers to both to the fact that these lesions are associated with an increased future risk of developing breast cancer in either breast and that there is a 13-57% chance that the lesion will upgrade to malignancy on surgical excision (1-3).
Unfortunately, no standard DCE MRI features have been shown to be useful for predicting which lesions require surgery (3). Although management of high-risk lesions is somewhat controversial with a few recent studies suggesting some forms of lobular carcinoma in situ and atypical lobular hyperplasia (together termed “lobular neoplasia”) can safely avoid excision (5, 4), women at high lifetime risk for developing breast cancer should be referred for surgical excision.

In this particular case, this patient at elevated lifetime risk of developing breast cancer was diagnosed with lobular carcinoma in situ, a high-risk lesion. As a result, mammographic-guided wire localization targeting the biopsy marker clip and surgical excision were performed. Final pathology revealed mixed ductal and lobular carcinoma in situ, which constituted an upgrade to malignancy.


