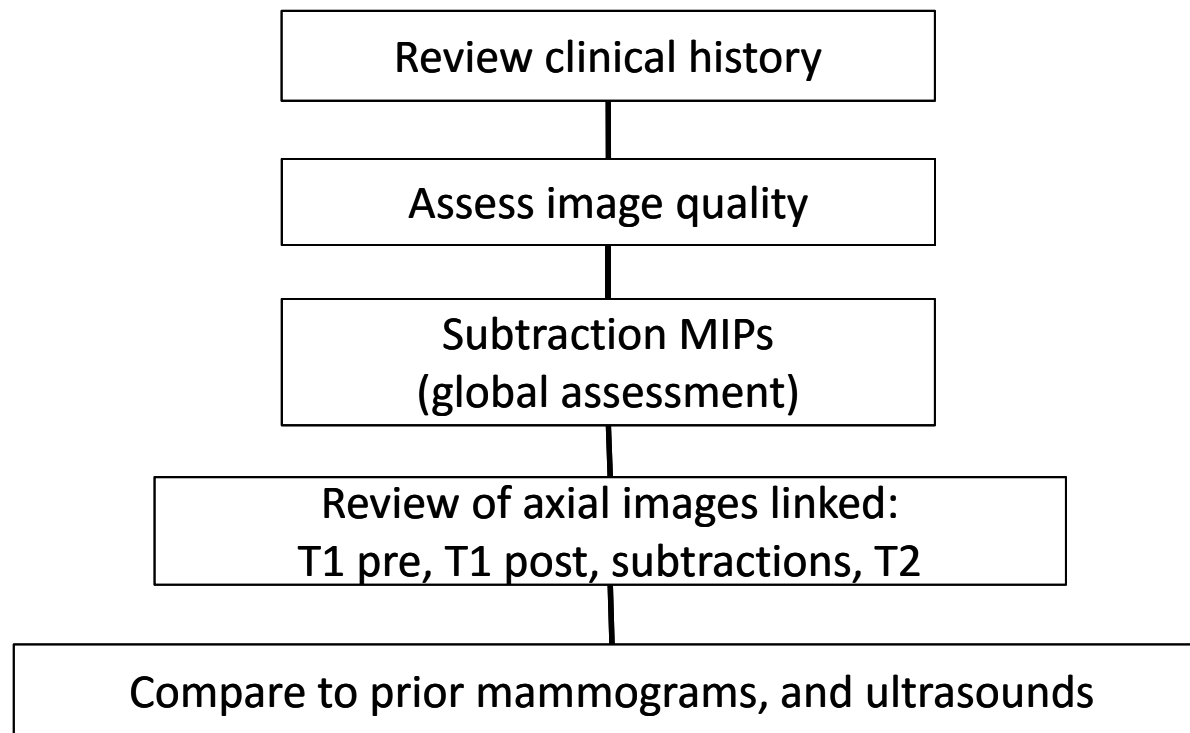


AB-MR Interpretation Overview

- Goal of AB-MR interpretation is to maintain high sensitivity and specificity
- In order to minimize false positives and short term follow ups, it is fundamental to focus only on findings truly unique to the background parenchymal enhancement (BPE)

Approach to AB-MR Interpretation Readout



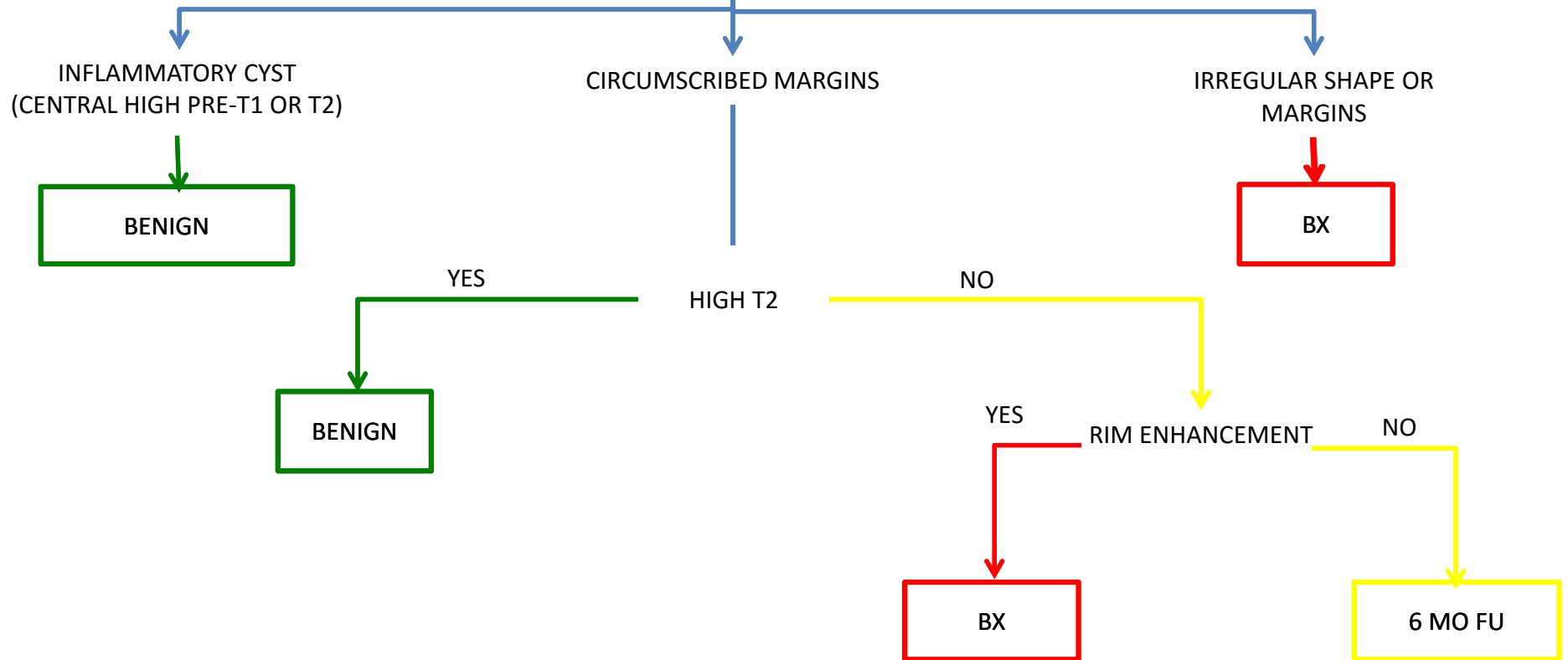
Classification of Unique Findings

- Focus
- Mass
- Non-mass enhancement

Approach to Unique Focus on Baseline AB-MR

- Focus should be a unique finding and distinct from the BPE.
 - No other similar focus should be present elsewhere in that breast or in the contralateral breast.
- Biopsy and follow up reserved for focus 3 - <5mm in size

Unique 3- <5 mm Focus on Baseline AB-MR:
Single, dominant

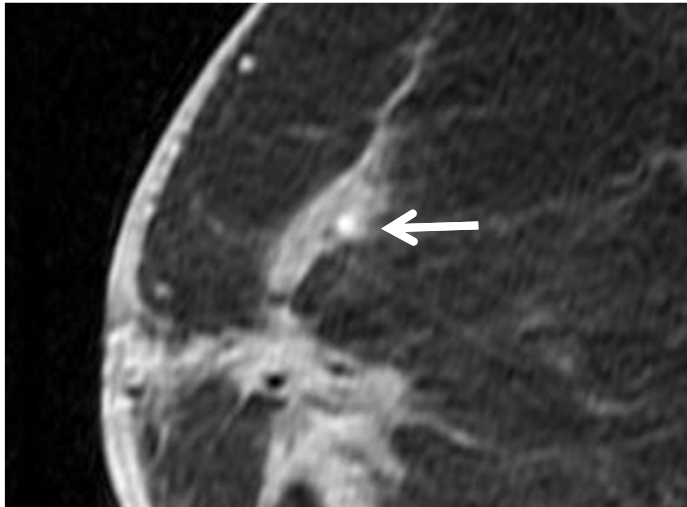


Approach to Unique Focus

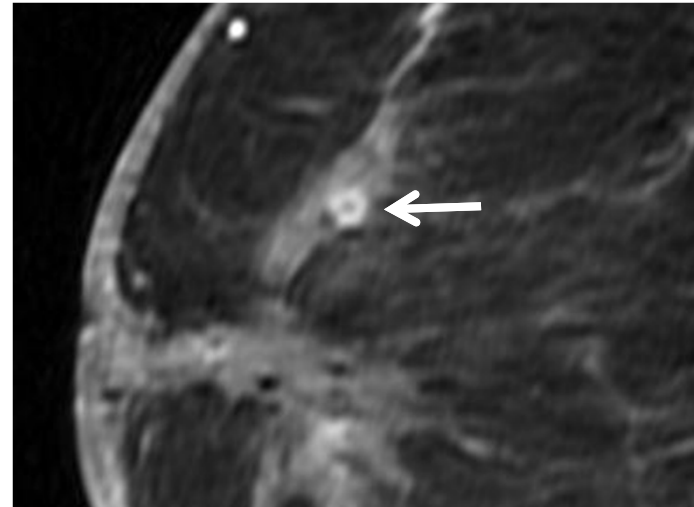
- First step: Exclude small inflammatory cysts which are benign

Small Inflammatory Cyst

Pre-contrast T1



Post-contrast T1



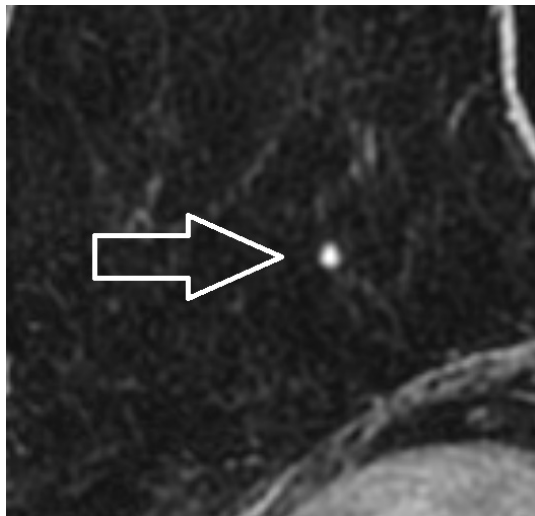
Pre-contrast T1 image demonstrates a high T1 focus matching the central cavity on the post-contrast image.

Approach to Unique Focus

- Next step: Evaluate margins
 - Is it circumscribed or not circumscribed?

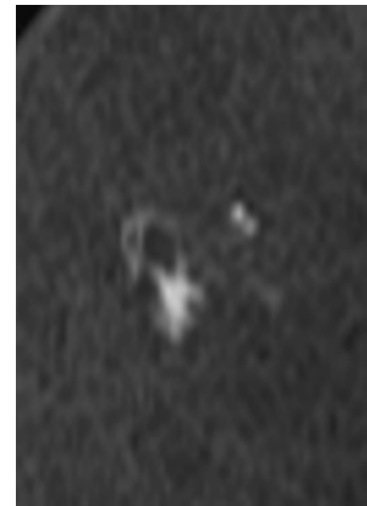
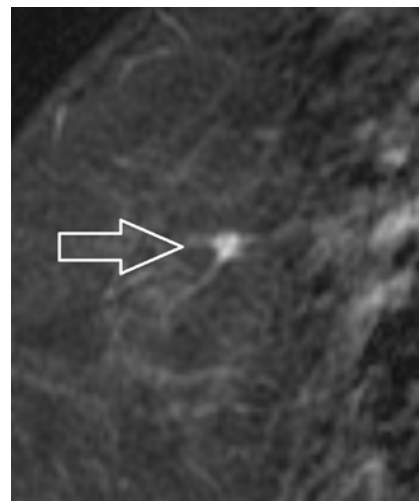
Unique 3- ≤5 mm Focus on Baseline AB-MR:
Single, dominant

CIRCUMSCRIBED MARGINS



NEED TO ASSESS
ADDITIONAL FEATURES

IRREGULAR SHAPE OR
MARGINS



BX

Unique Focus

- Margins not circumscribed → Biopsy
- Margins circumscribed → Evaluate T2 signal

Circumscribed Unique Focus

- If there is a unique circumscribed focus, then evaluate T2 SI:
 - High T2: Higher than normal gland, equivalent to cysts, blood vessels or lymph nodes
 - Otherwise considered intermediate or low T2
- When evaluating T2 images, window image appropriately to appreciate differences in signal intensity between fat, tissue, and fluid
 - Cysts and blood vessels should be bright but not over-saturated
 - If window and level are set at too narrow of a range, then areas may falsely appear as being bright on T2 images

Unique 3-<5 mm Focus on Baseline AB-MR:
Single, dominant

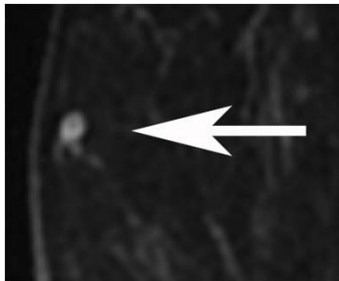
CIRCUMSCRIBED MARGINS

YES

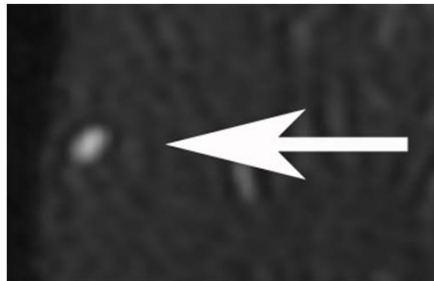
HIGH T2?

NO

T1 POST



T2



BENIGN

NEED TO ASSESS
ADDITIONAL FEATURES

Unique Circumscribed Focus NOT High on T2

- If there is a circumscribed unique focus that is not high on T2 images, is there rim enhancement?
 - Yes: Biopsy
 - Rim enhancement is suspicious enough to warrant biopsy
 - No: 6 month follow up

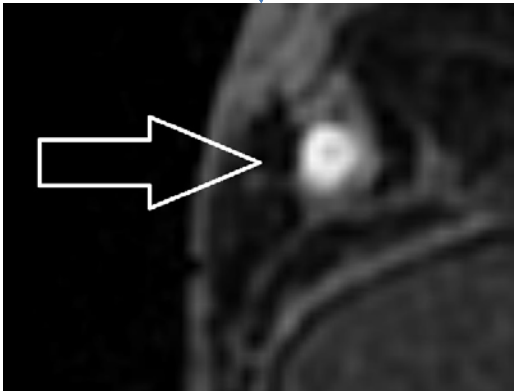
Unique 3-≤5 mm Focus on Baseline AB-MR:
Single, dominant

CIRCUMSCRIBED MARGINS
AND
LOW OR INTERMEDIATE T2

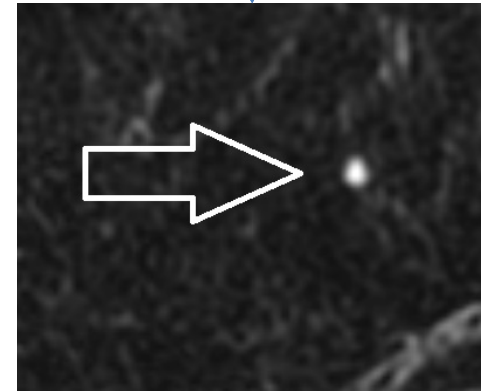
RIM ENHANCEMENT

YES

NO

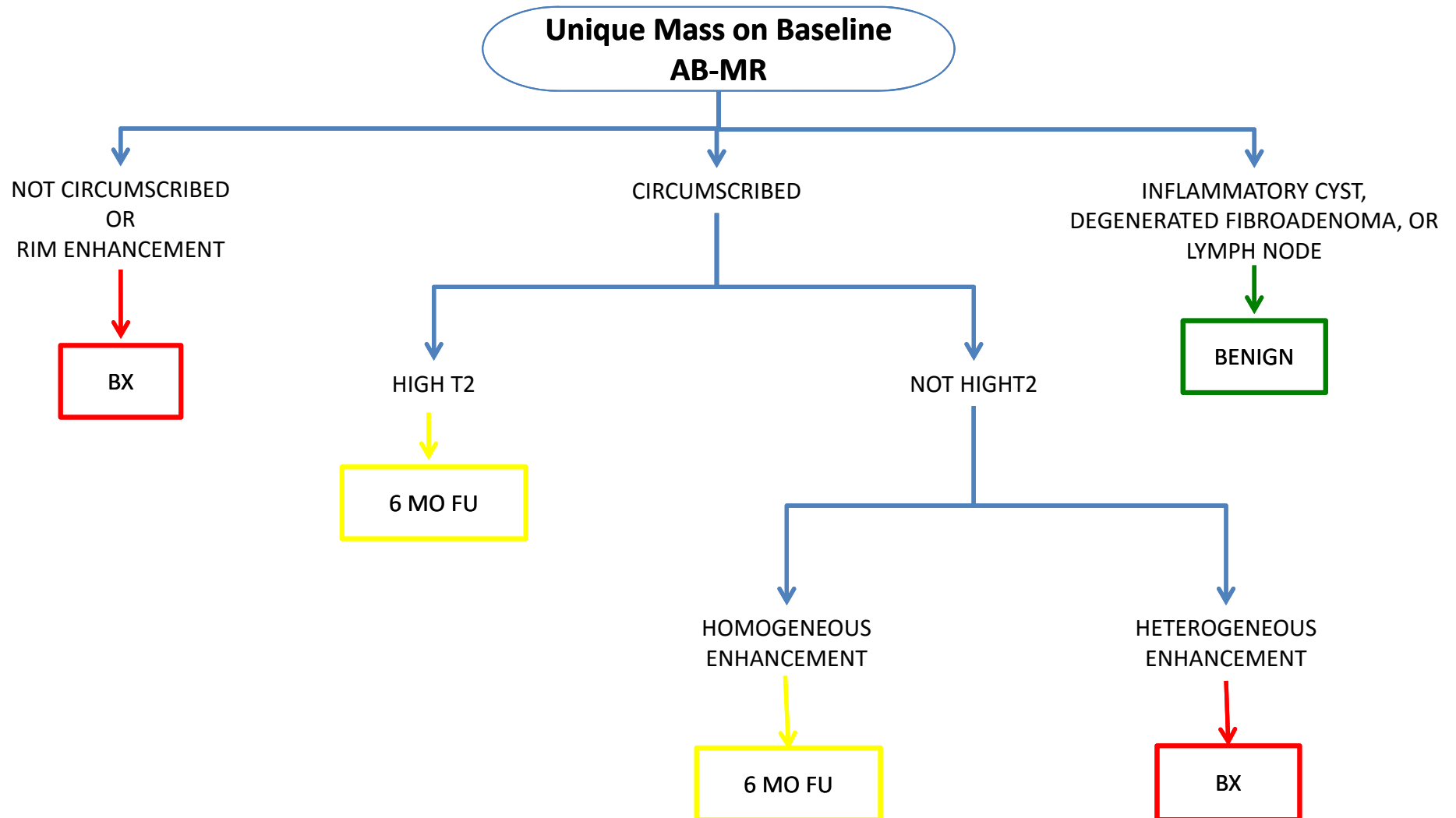


BIOPSY



6 MONTH FOLLOW UP

Approach to Unique Mass



Approach to Unique Mass

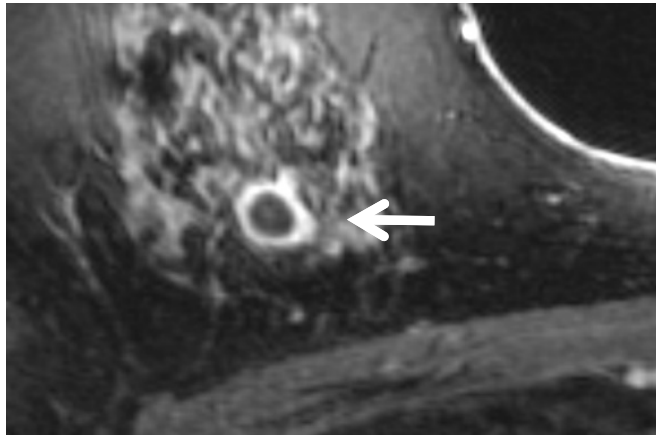
- Exclude classically benign masses:
 - Inflammatory cysts
 - Lymph nodes
 - Degenerated fibroadenomas

Classically Benign Mass: Inflammatory Cyst

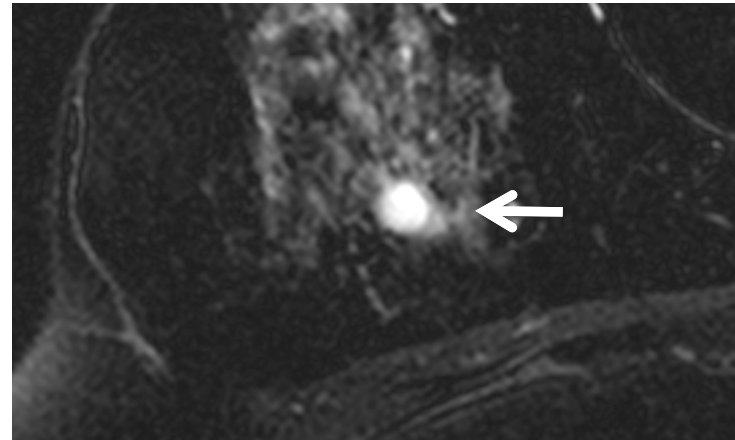
- Rim enhancing mass with a high signal correlate on pre-contrast T1 or T2 weighted images
 - Correlate must match in SIZE AND SHAPE to the inner cavity of the rim enhancement on the post-contrast images
 - Interface between the dark inner cavity and peripheral enhancement (inner wall) must be smooth

Classically Benign Mass: Inflammatory Cyst

Post-contrast T1



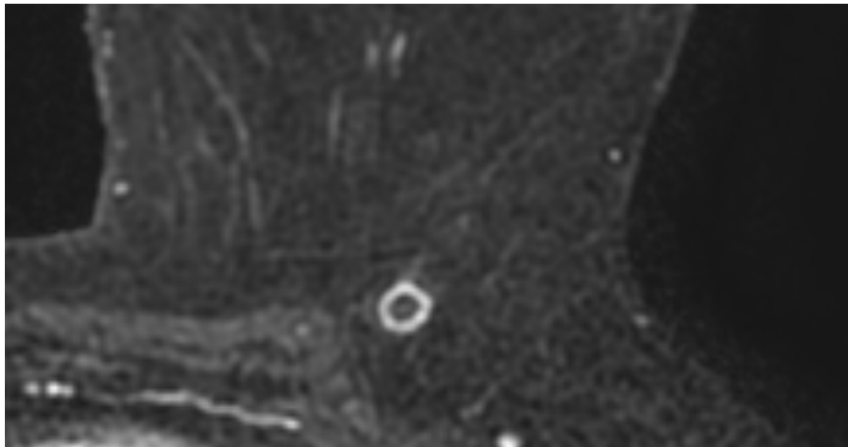
T2



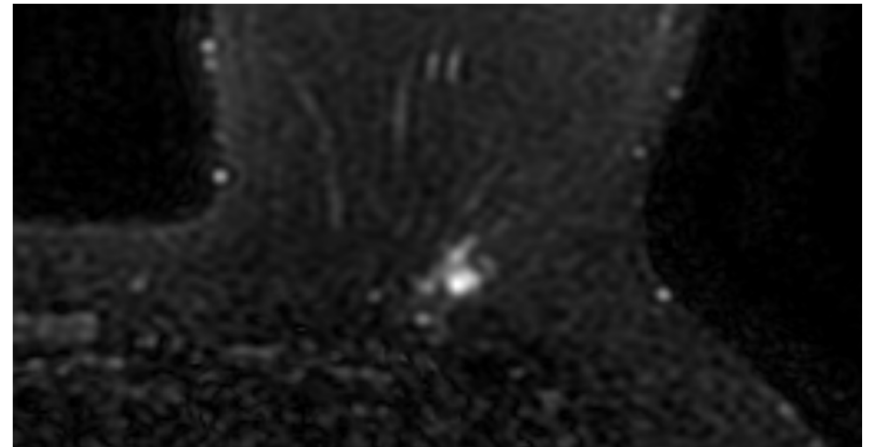
The T2 fluid component matches the size and shape of the inner cavity on the post-contrast T1 image. Also, the interface between the inner cavity and peripheral enhancement is smooth

NOT Inflammatory Cyst (Rim enhancing mass)

Post- contrast T1



T2



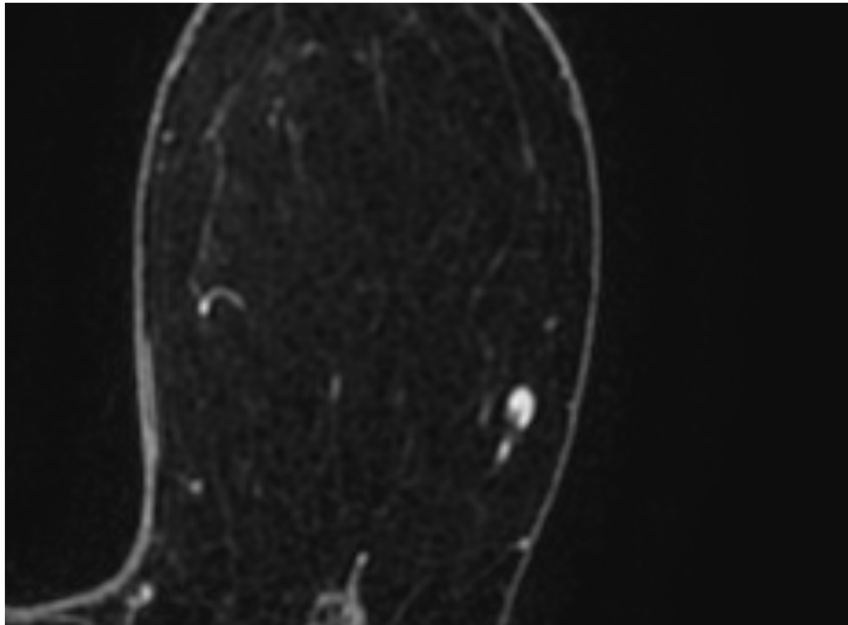
Although there is a high correlate on the T2 weighted image, the high T2 correlate is smaller and **does not match the central dark area on the post-contrast T1 in terms of size and shape**. The T2 correlate is smaller than the central cavity area on the post-contrast images. This was a high grade IDC.

Classically Benign Mass: Lymph Node

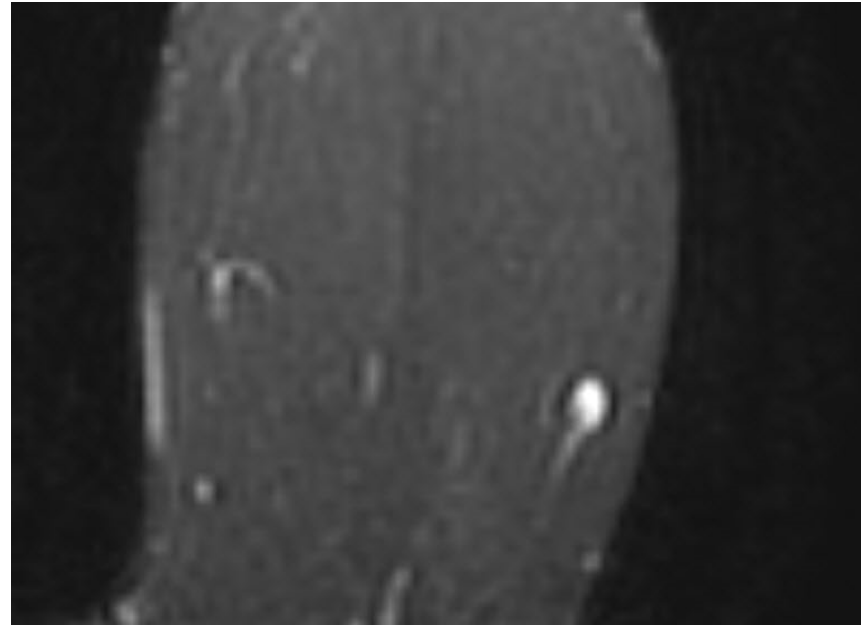
- Intramammary lymph nodes are the following:
 - Circumscribed
 - Lobulated
 - High on T2 weighted images
 - Usually located superficially in the upper outer quadrant and commonly adjacent to blood vessels

Classically Benign Mass: Lymph Node

Post-contrast T1



T2

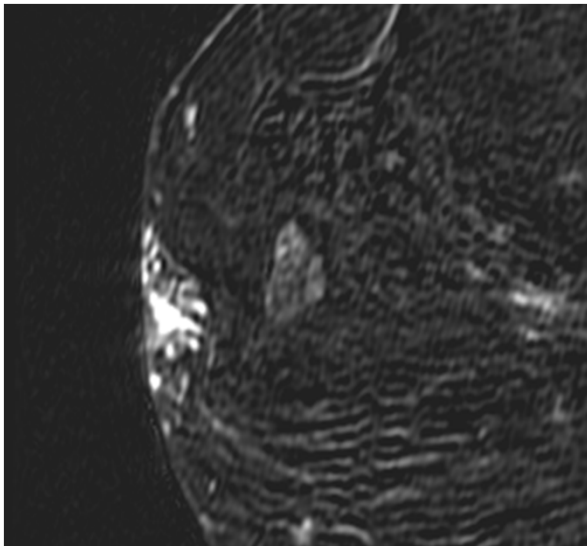


Classically Benign Mass: Degenerated Fibroadenoma

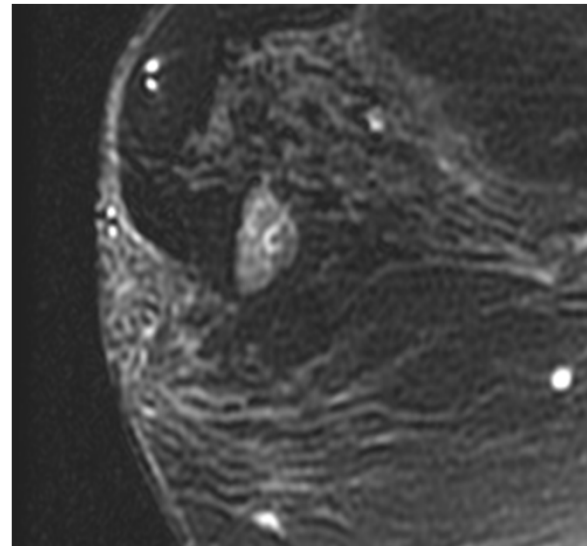
- Degenerated fibroadenoma
 - Circumscribed
 - Intermediate or low T2 signal
 - Dark internal septations
 - Low level enhancement (i.e.- incomplete enhancement above a 50% threshold)
- Probably fibroadenoma on a baseline MR should be given a BI-RADS 3. However, it is the **low level partial enhancement** that justifies a BI-RADS 2 recommendation on a baseline AB-MR

Classically Benign Mass: Degenerated Fibroadenoma

Subtraction





T2



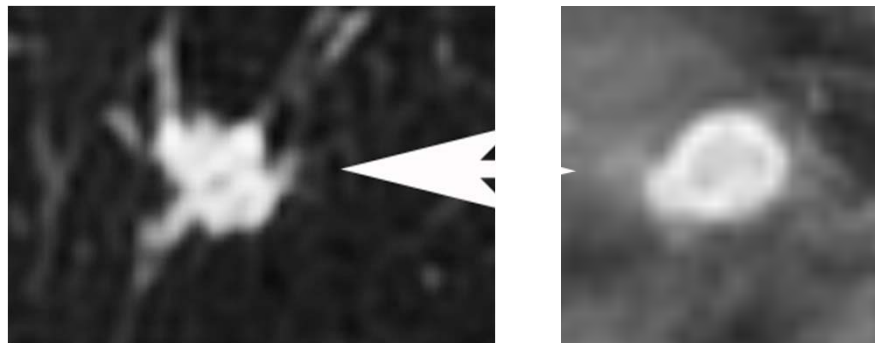
Because the circumscribed, low T2 mass minimally and incompletely enhances, a BI-RADS 2 recommendation is appropriate

Approach to Unique Mass

- Once classically benign masses (inflammatory cysts, lymph nodes, degenerated fibroadenomas) are excluded, evaluate margins:
 - Circumscribed  Assess other imaging features
 - Not circumscribed OR rim enhancing  Biopsy
 - Any unique mass with non- circumscribed margins or rim enhancement on a baseline AB-MR must be biopsied

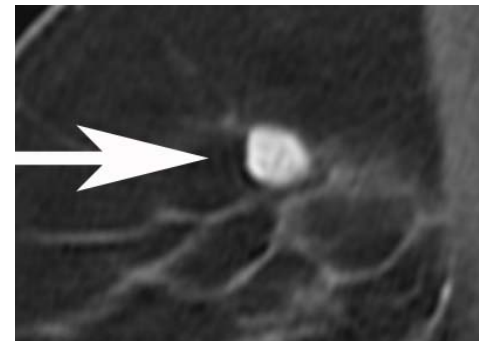
Unique Mass on Baseline AB-MR

NOT CIRCUMSCRIBED
OR
RIM ENHANCEMENT



BX

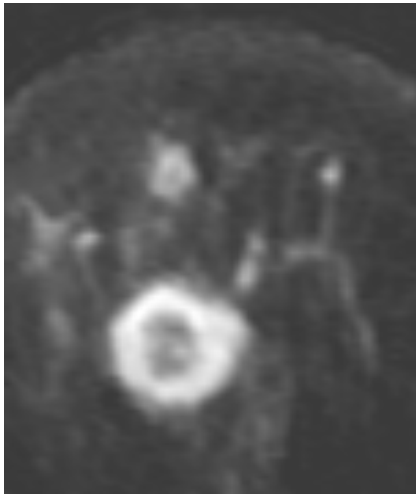
CIRCUMSCRIBED MARGINS



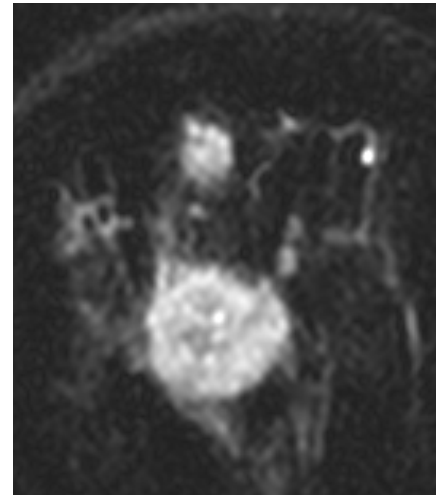
NEED TO ASSESS
ADDITIONAL FEATURES

Unique Rim Enhancing Mass

Post-contrast T1



T2



Rim enhancement on the post-contrast T1 weighted images is within the area that is high on the T2 sequence. The high T2 signal does not match in size and shape to the dark central cavity on the post-contrast T1 weighted image. This distinguishes a rim enhancing mass from an inflammatory cyst. **Biopsy should be recommended for all rim enhancing masses, regardless of other imaging features (ie- high T2 correlate and circumscribed margins).**

Unique Circumscribed Mass

- If there is a unique circumscribed, NOT rim enhancing mass, the next step is to evaluate for a high T2 signal intensity correlate

Unique Mass on Baseline AB-MR

CIRCUMSCRIBED

HIGH T2



T1 post



T2

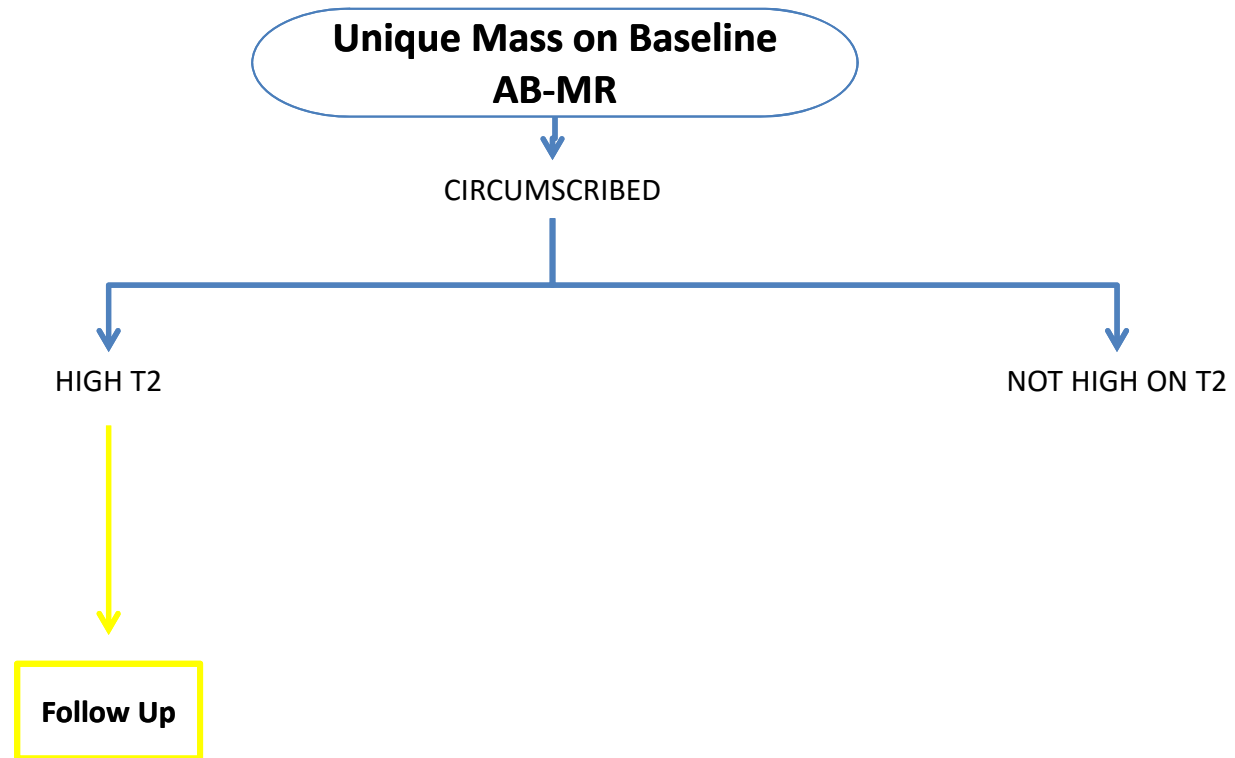
NOT HIGH ON T2



T1 post

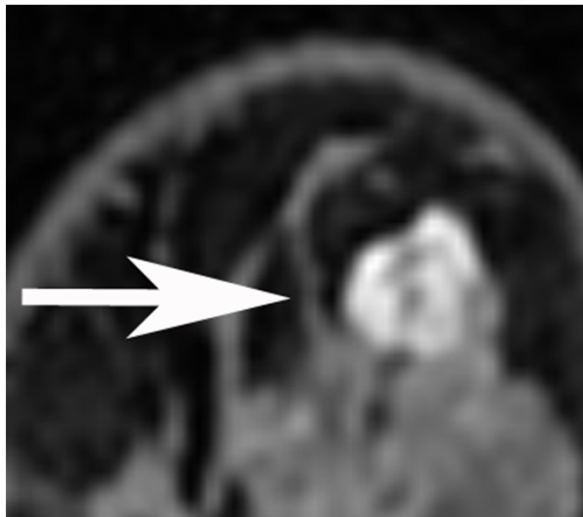


T2

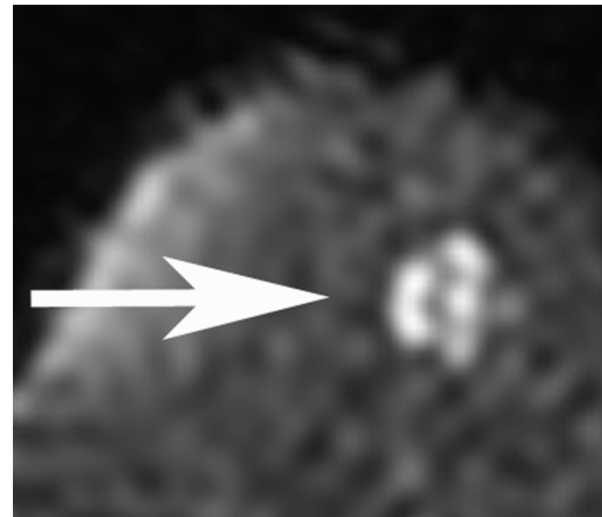


Unique Circumscribed High T2 NON-Rim Enhancing Mass

Post-contrast T1





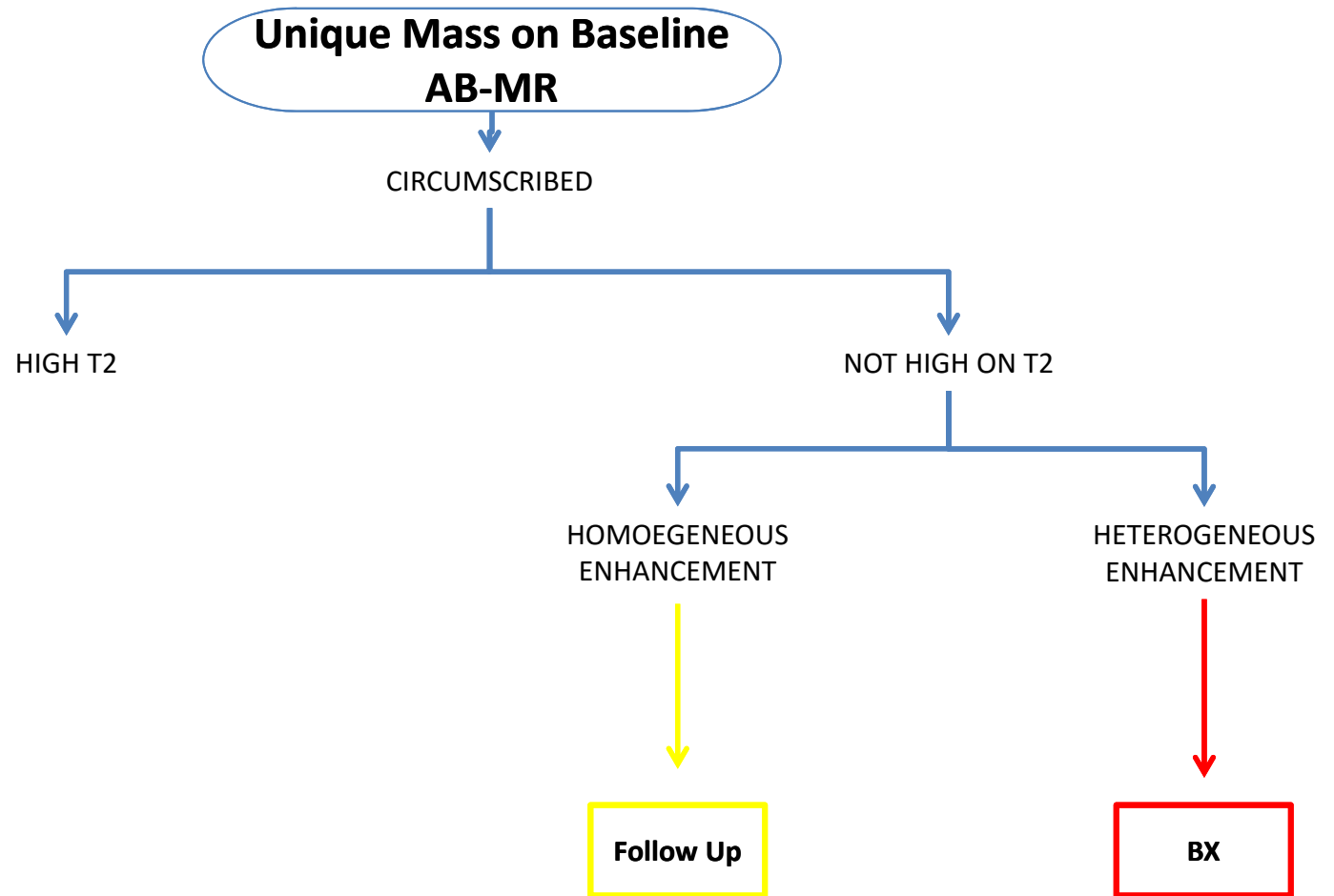
T2



A **6 month follow up** is appropriate for a circumscribed, high T2 homogeneously or heterogeneously enhancing mass on a baseline AB-MR. Breast cancers that are high signal on T2 weighted images are unusual unless rim enhancement or irregular margins are present.

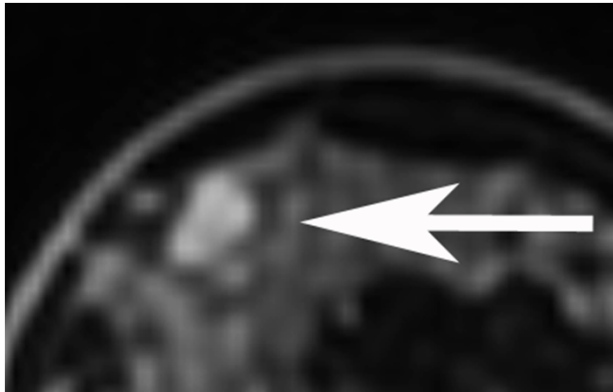
Unique Circumscribed, NOT Rim Enhancing High T2 Mass

- Presence of a high T2 signal correlate for a circumscribed unique, non rim enhancing mass is highly suggestive of a benign etiology
 - If rim enhancing  Biopsy
 - If homogeneous or heterogeneous enhancement
 6 month follow up

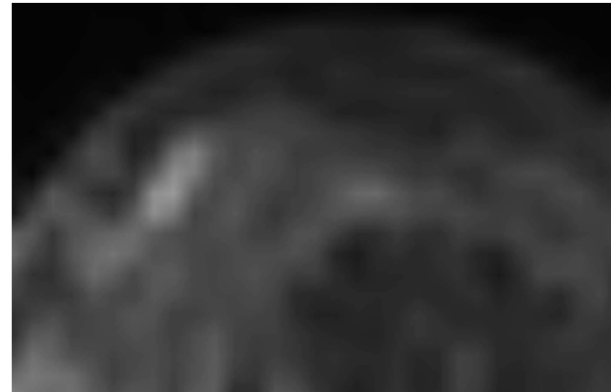


Unique Circumscribed NOT High T2 Homogeneously Enhancing Mass

Post-contrast T1

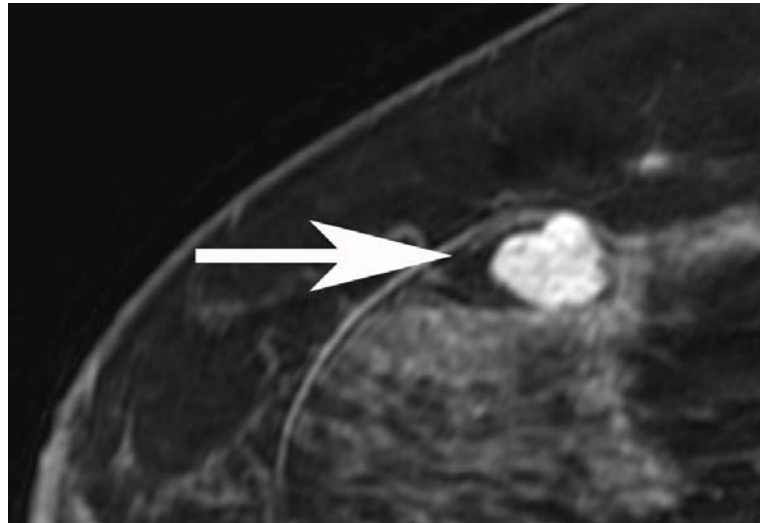


T2



This is an example of a circumscribed homogeneously enhancing mass with thin dark internal septations that is not high signal intensity on the T2 weighted images. A 6 month follow up would be appropriate.

Unique Circumscribed NOT High T2 Heterogeneously Enhancing Mass

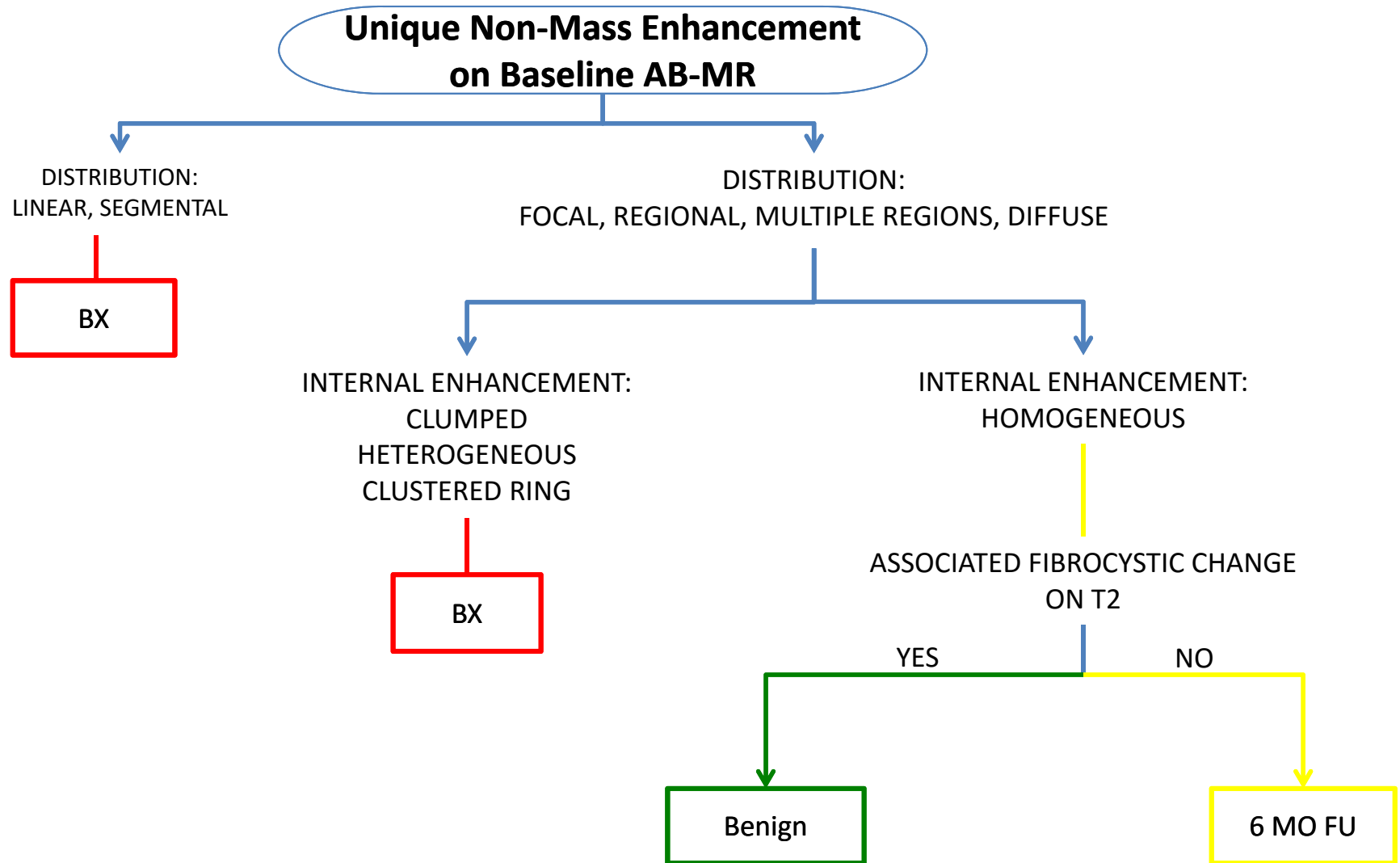


This is an example of a circumscribed heterogeneously enhancing mass that is not high signal intensity on the T2 weighted images. Biopsy should be recommended for a circumscribed, NOT high T2 signal intensity mass with either heterogeneous or rim enhancement.

Unique Circumscribed Not Rim Enhancing Mass NOT High on T2

- If there is a unique circumscribed, non rim-enhancing mass that is not high on T2, management will depend on the internal enhancement pattern
 - If heterogeneously enhancing → Biopsy
 - If homogeneously enhancing (can include thin non-enhancing septations) → 6 month follow up

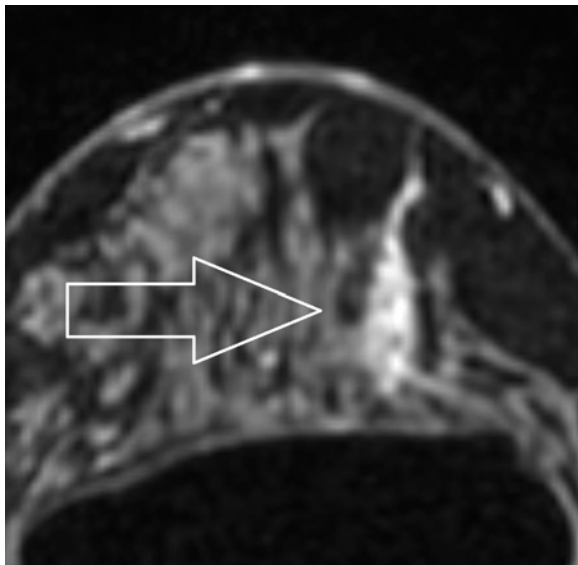
Approach to NME



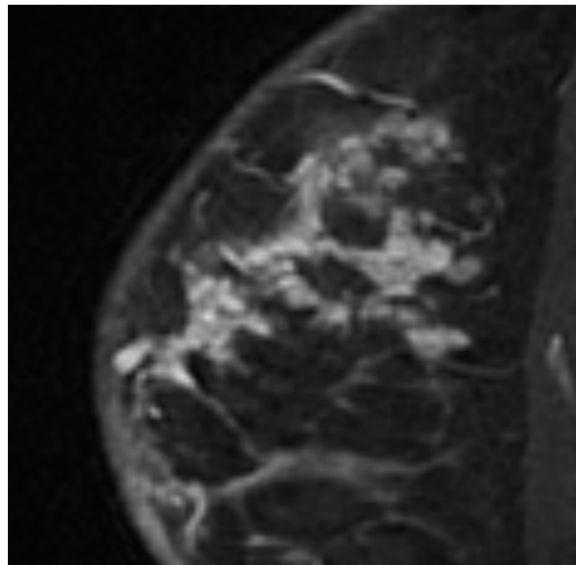
Approach to Unique Non-mass Enhancement

- Management depends on distribution and internal enhancement:
 - Linear or segmental distribution → Biopsy
 - Clumped, heterogeneous, or clustered ring → Biopsy

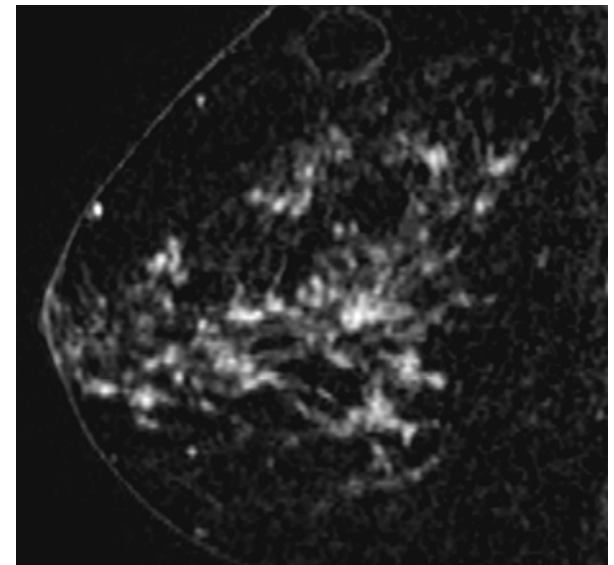
Suspicious NME



Linear, clumped NME

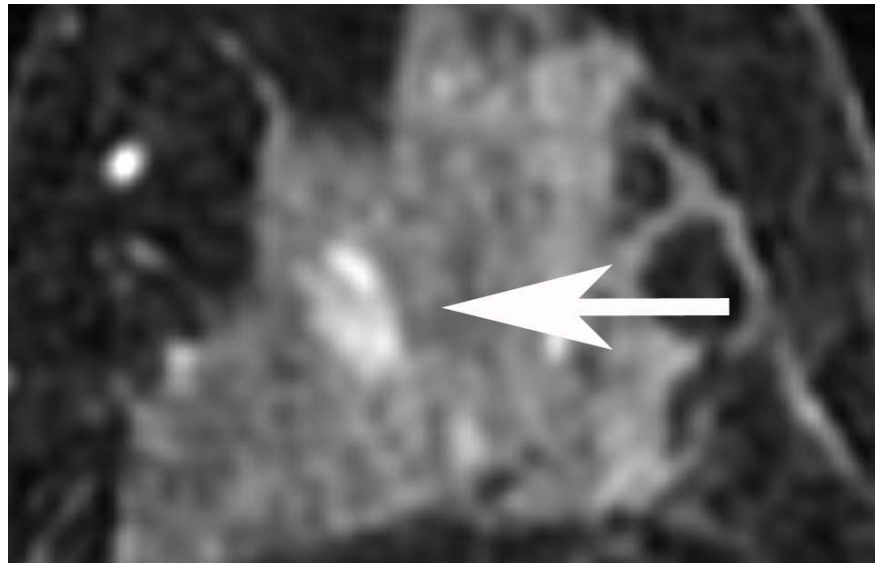


Segmental clumped and heterogeneous NME



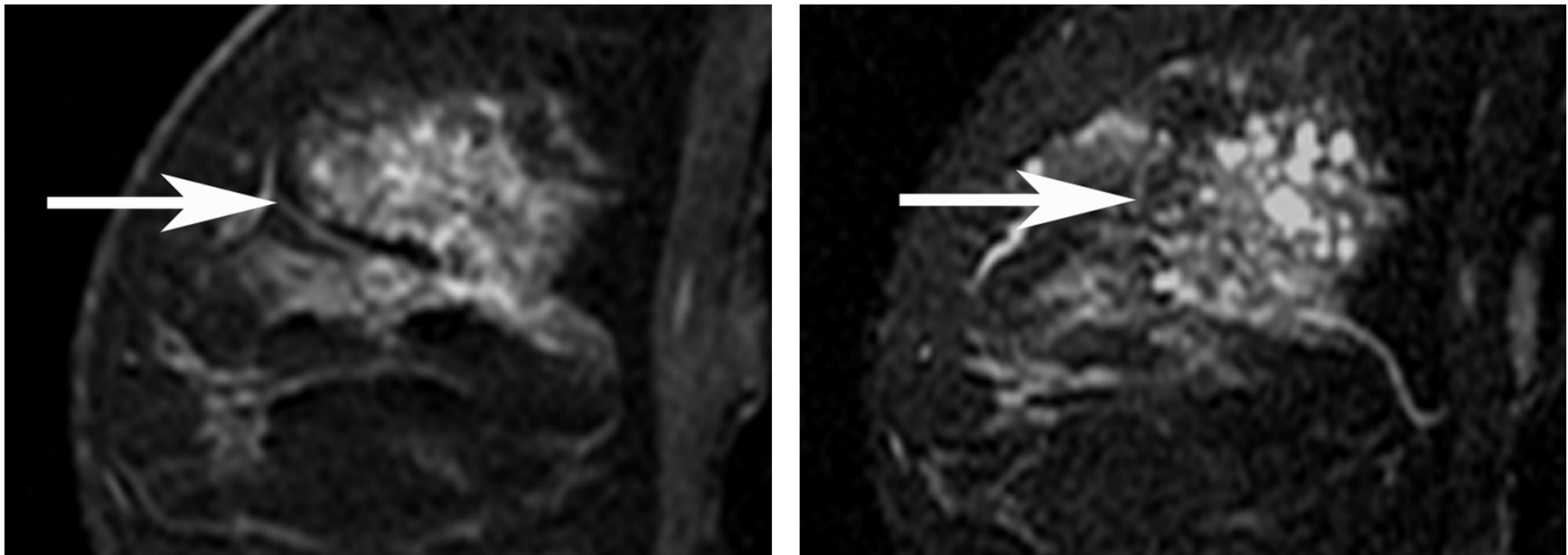
Multi-regional clumped and heterogeneous NME

Probably Benign NME



A 6 month follow up is appropriate for a focal area of NME that is not high signal intensity on the T2 weighted sequence.

Benign NME



There is a focal area of NME with a high signal intensity correlate on the T2 weighted sequence. No biopsy or follow up is necessary.

Unique homogeneous NME NOT in a linear or segmental distribution

- Unique homogeneous NME is the least suspicious pattern of NME
 - If there is a high T2 correlate, this likely represent focal fibrocystic change → Benign
 - If no high T2 correlate → 6 month follow up