AMSER Case of the Month October 2022

45-year-old female with bilateral palpable breast lumps

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Patient Presentation

- HPI: 45-year-old female presents with bilateral palpable breast lumps. First palpated right breast mass 16 months ago which has since increased in size. Left breast mass 4-5 month ago which is unchanged in size.
- PMH: Type 2 Diabetes Mellitus
- PSH :No significant history
- FH: No significant history
- Physical Exam:
- Right: Firm 4cm mass in 9 o'clock position 4cmfn, minimal skin retraction
- Left: 3cm mobile smooth nodule in 2 o'clock position 2cmfn
- No nipple inversion, discharge tenderness or axillary or supraclavicular adenopathy

What Imaging Should We Order?

ACR Appropriateness Criteria for palpable breast mass in a female 40 years of age or older

Variant 1: **Palpable breast mass. Female, 40 years of age or older, initial evaluation. (See Appendices 1A-1B for additional steps in the workup of these patients.)**

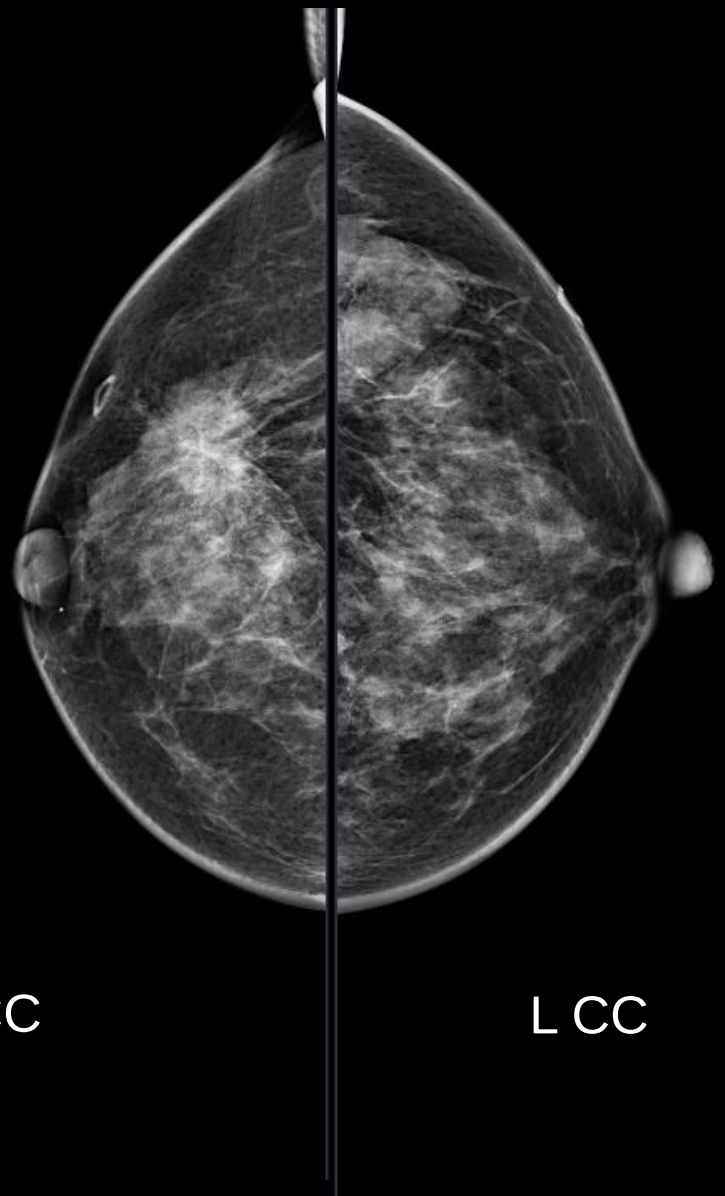
Radiologic Procedure	Rating	Comments	RRL*
Mammography diagnostic	9	See references [13-15].	☢☢
Digital breast tomosynthesis diagnostic	9	See references [16-18,20,85].	☢☢
US breast	4	If she had recent mammogram (ie, past 6 months), US may be appropriate.	O
MRI breast without and with IV contrast	2	See references [4,49].	O
MRI breast without IV contrast	1		O
FDG-PEM	1		☢☢☢☢
Sestamibi MBI	1		☢☢☢
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level

- Diagnostic mammography, bilateral digital tomosynthesis were ordered to evaluate both palpable masses.

Diagnostic Mammogram (no priors) (not labeled)



R CC

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R MLO

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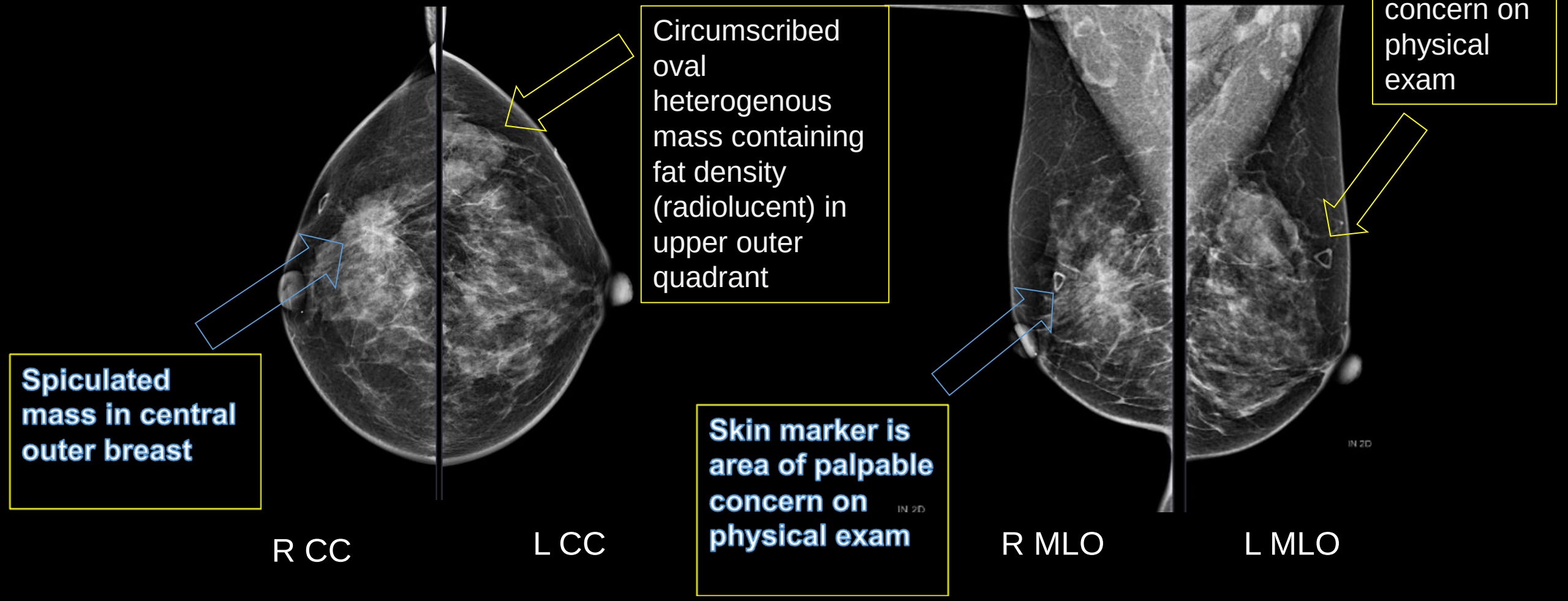
Diagnostic Mammogram (no priors) (labeled)



What Additional Imaging Should We Order?

ACR Appropriateness Criteria for palpable breast mass in a female 40 years of age or older

Right Breast Mass:

These two tests were performed due to findings on mammography BI-RADS 5

Variant 2: **Palpable breast mass. Female, 40 years of age or older, mammography findings suspicious for malignancy. Next examination to perform. (See Appendix 1A for additional steps in the workup of these patients.)**

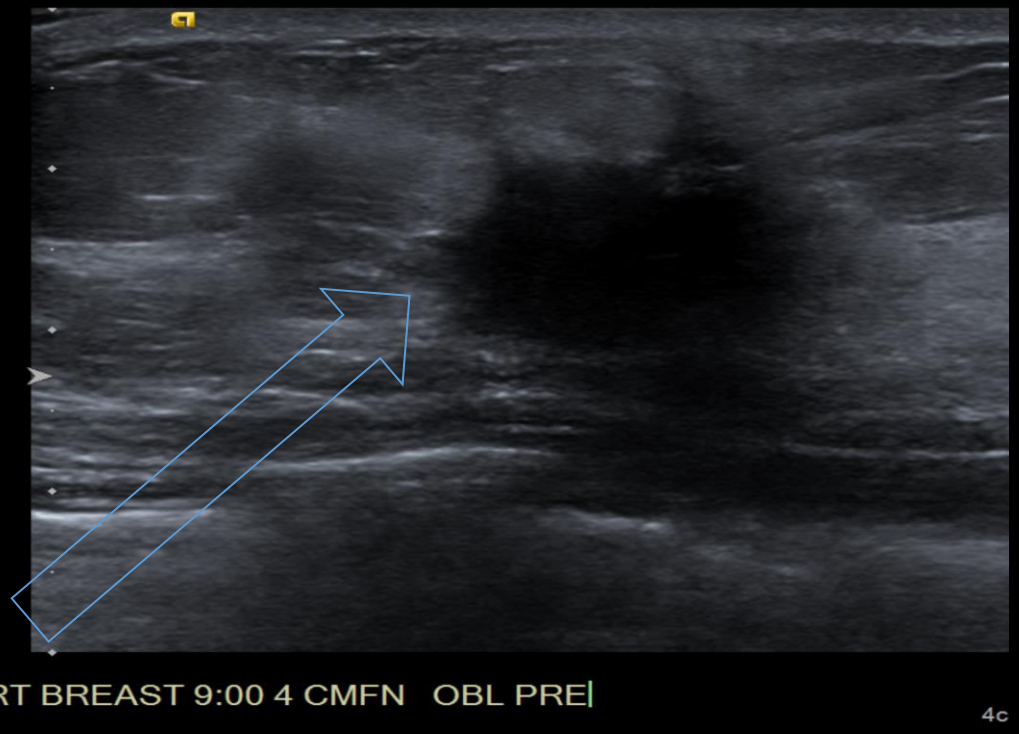
Radiologic Procedure	Rating	Comments	RRL*
US breast	9	See reference [62].	O
MRI breast without and with IV contrast	2	See references [4,49].	O
Image-guided core biopsy breast	2		Varies
Mammography short-interval follow-up	1		☢☢
Digital breast tomosynthesis short-interval follow-up	1		☢☢
MRI breast without IV contrast	1		O
FDG-PEM	1		☢☢☢☢
Sestamibi MBI	1		☢☢☢
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: **1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate** ***Relative Radiation Level**

Left Breast Mass:

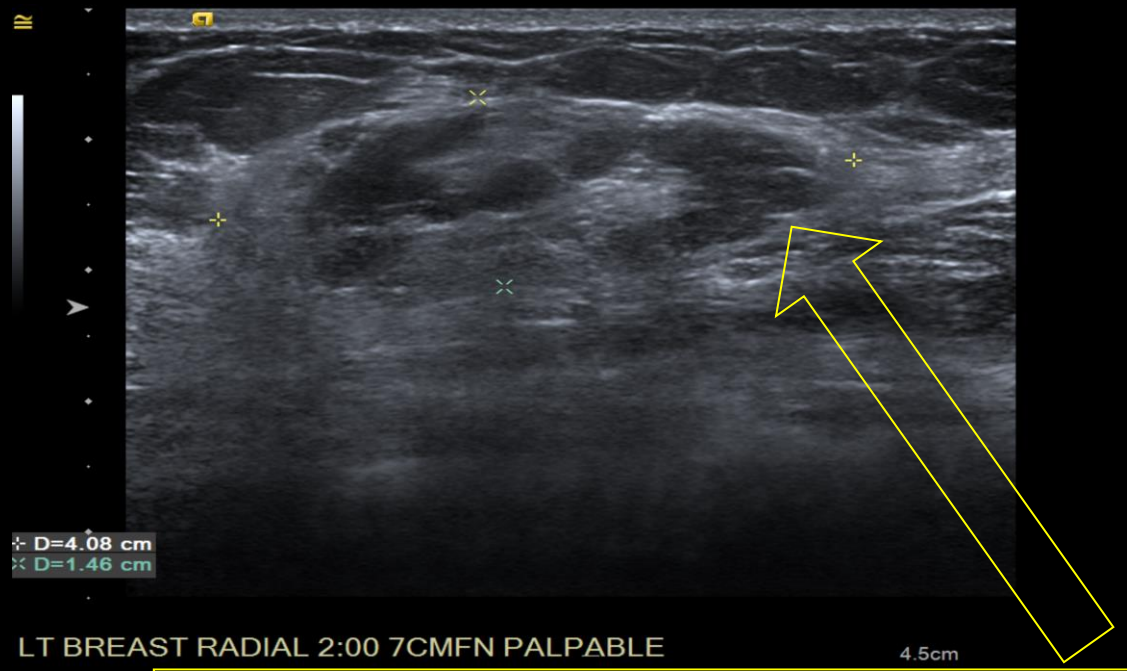
These two tests were performed due to high index of suspicion in the contralateral breast

Right Breast Mass on Ultrasound (Labeled)



Hypoechoic 24 mm irregularly shaped mass with angular margins located at 9 o'clock 4cm from nipple.
Posterior shadowing. Mass extends into subcutaneous tissue toward skin.

Left Breast Mass on Ultrasound (Labeled)



Heterogenous 41 mm x 15 mm x 38 mm oval mass, circumscribed margins located at 2 o'clock 7 cm from the nipple.
Hypoechoic areas are isoechoic with subcutaneous fat, separated by a thin hyperechoic rim. These features are concordant with 2D mammography.

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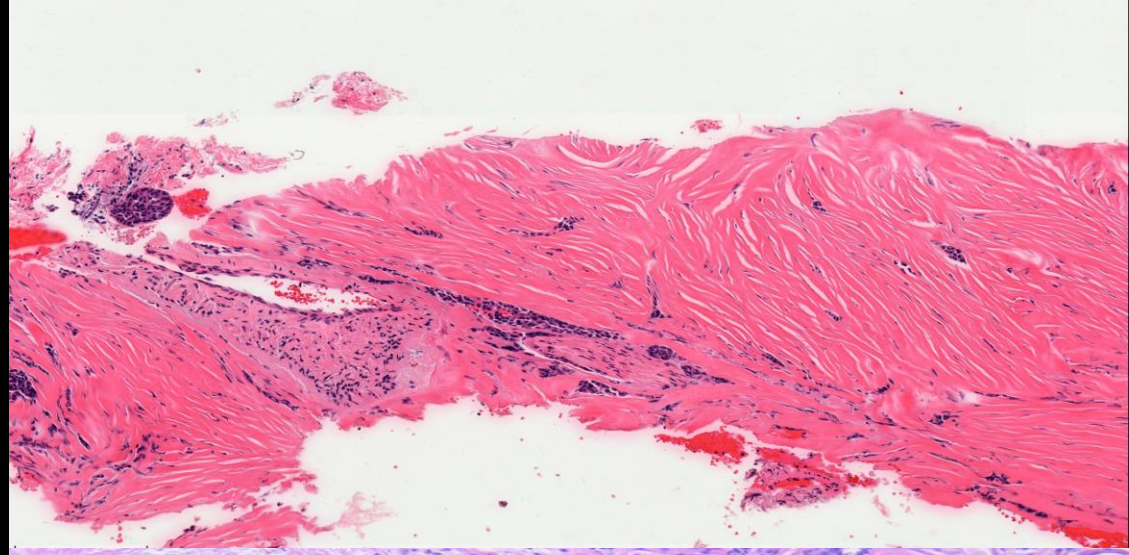
DDX (Based on Imaging)

Right Breast Mass	Left Breast Mass
Invasive Ductal Carcinoma (IDC)	Hamartoma
Invasive Lobular Carcinoma (IDC)	Tumoral Pseudoangiomatous Stromal Hyperplasia (PASH)
Invasive Tubular Carcinoma	Fibroadenoma (less likely due to radiolucency within encapsulated mass seen on 2D mammography)
Sclerosing Adenosis	
Radial Scar	

Final Dx

RIGHT: Invasive ductal carcinoma, ER positive, PR HER2 negative

Fig A.



LEFT: Benign breast tissue with focal pseudoangiomatous stromal hyperplasia (PASH) and adipose tissue, hamartoma

Fig B.

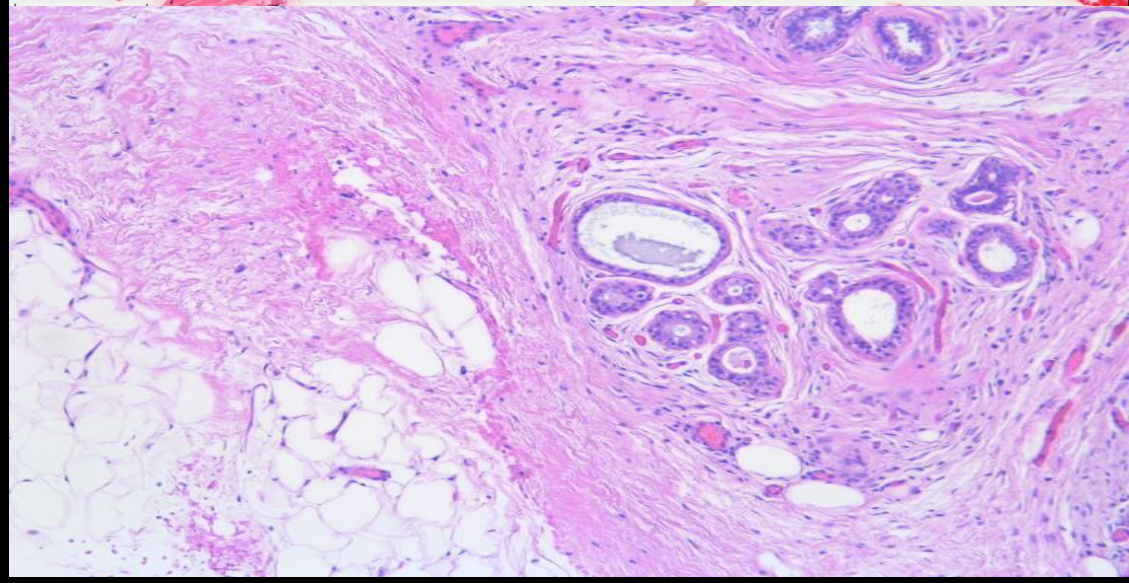


Fig A. H&E section (10x) from right breast shows dense sclerotic stroma with carcinoma cells in small nests and groups. Fig B. H&E section (10x) from left breast shows benign breast tissue and adipose tissue, suggestive of hamartoma

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Breast MRI Indications

- Occult malignancy (mammogram negative and nodal involvement on ultrasound).
- High-risk supplemental screening (genetic predisposition, calculated lifetime risk of >20%, history of chest or mantle radiation therapy at a young age).
- Pre-operative Imaging – Evaluate for extent of disease, nodal involvement and contralateral breast (reason for MRI in this case).
- Monitoring breast cancer response to neoadjuvant chemotherapy.
- Evaluate for silicone implant integrity (non-contrast) saline implants are not indicated.

Dynamic Contrast Enhancement MRI (DCE-MRI)

- Breast cancers have dense, highly permeable vasculature resulting in stronger and more rapid enhancement relative to normal tissue.
- Gadolinium contrast is given intravenously, uptake and release of gadolinium are monitored at set time points.
- DCE-MRI supplements morphologic assessment of suspicious lesions.
- Slow wash-in is suggestive of benign lesions whereas rapid uptake is typical of malignancy. Rapid uptake can be persistent, plateau, or wash out (most suggestive of malignancy).

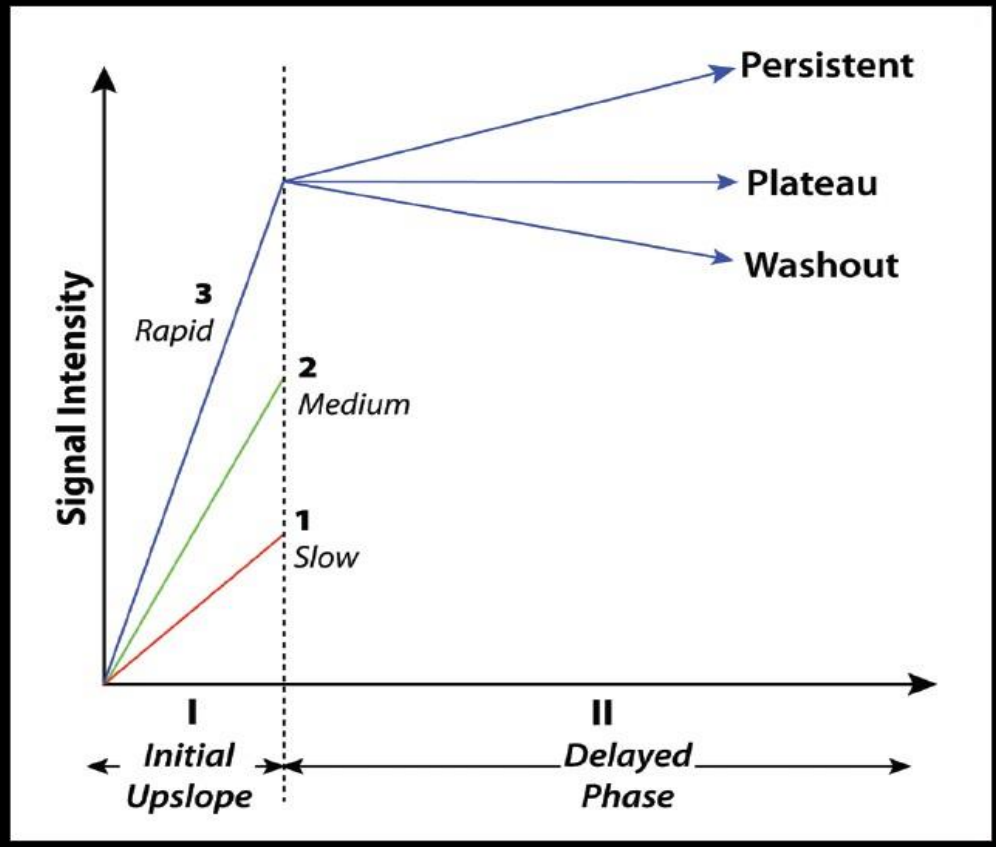


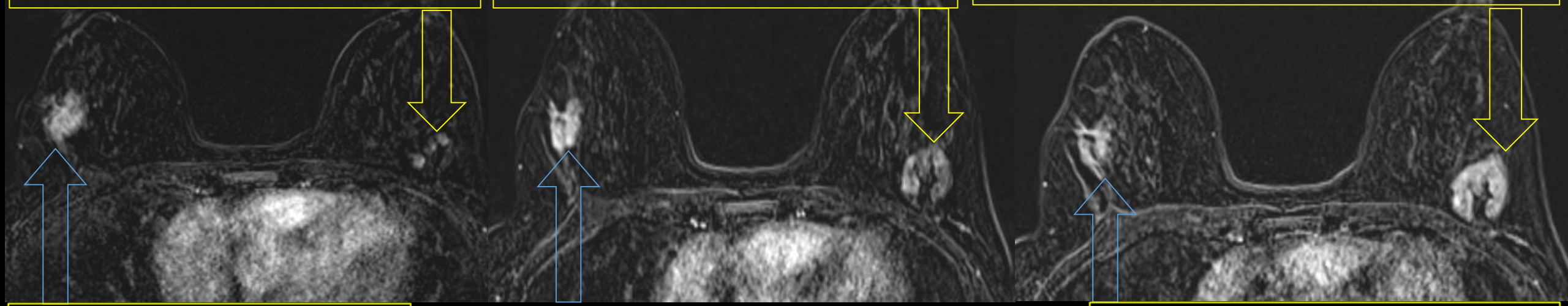
Fig. 1 Three types of enhancement kinetics seen with breast MRI (3)

DCE-MRI Enhancement Kinetics of Benign vs. Malignant Lesions

DCE-MRI post contrast, time 2:03
Initial Phase: delayed uptake in hamartoma

DCE-MRI post contrast, time: 2:05
Slow enhancing hamartoma

DCE-MRI post contrast, time: 2:10
Progressive enhancement in hamartoma



DCE-MRI post contrast, time: 2:03
Initial Phase: rapid uptake in IDC

DCE-MRI post contrast, time: 2:05
Strongest enhancement in IDC

DCE-MRI post contrast, time: 2:10
Wash out of IDC

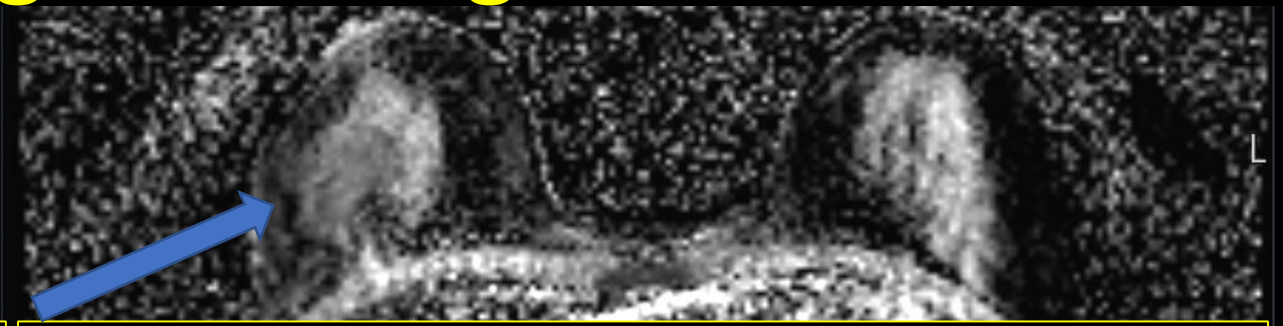
Right Breast Mass on MRI (Labeled)

Left Breast Mass on MRI (Labeled)

DWI and ADC of Benign vs Malignant Mass

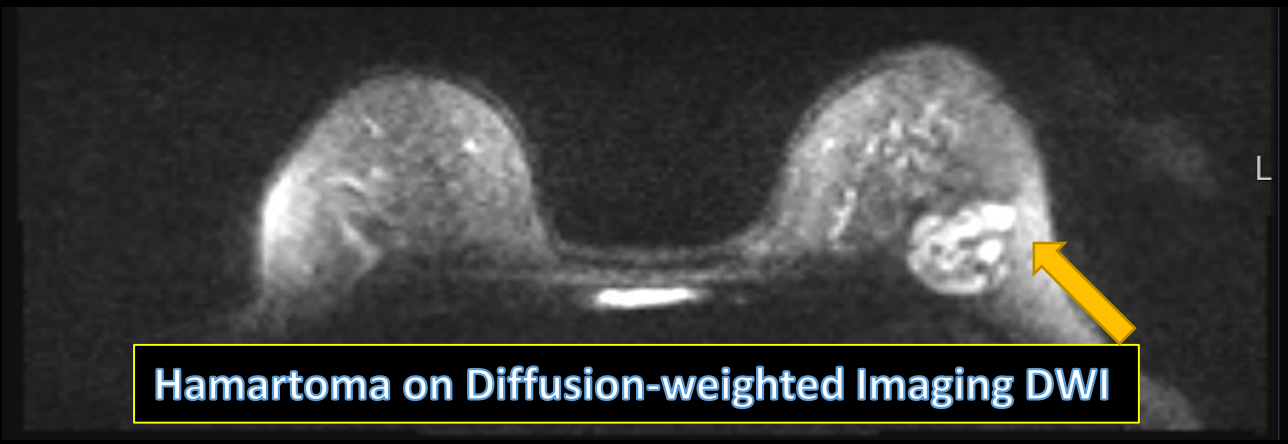
Invasive Ductal Carcinoma on Diffusion-weighted Imaging (DWI)

DWI is a technique that measures the mobility of water molecule within tissues. Breast carcinomas typically have reduced diffusion and appear hyperintense to normal surrounding tissue (as shown above).

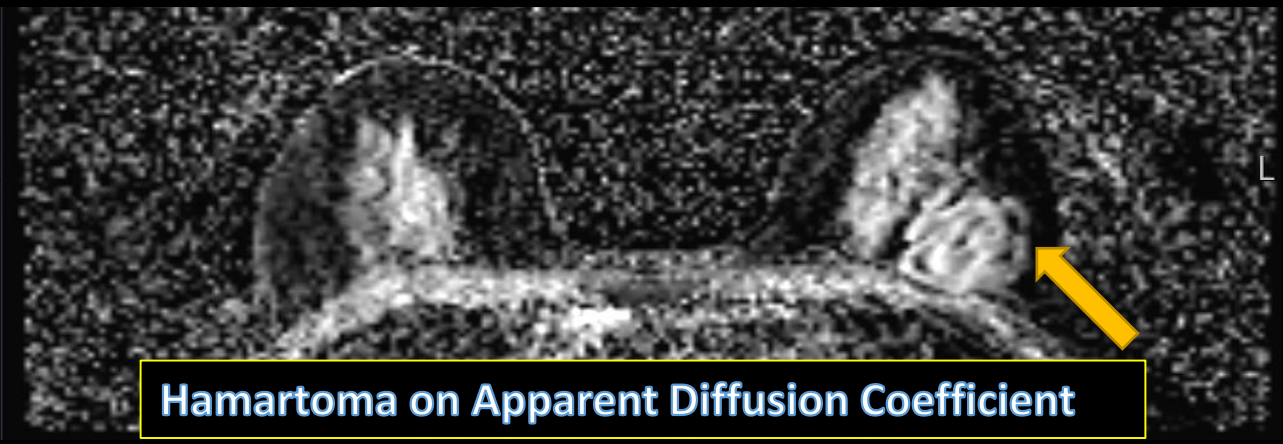


Invasive Ductal Carcinoma on Apparent Diffusion Coefficient (ADC)

Correlate findings on DWI with ADC to determine if malignancy is truly restricting diffusion or if T2 shine through phenomenon is cause of hyperintense signal on DWI. True diffusion restriction on ADC correlate (area is hypointense as shown above).



Hamartoma on Diffusion-weighted Imaging DWI



Hamartoma on Apparent Diffusion Coefficient

On DWI hamartomas do not show restriction. They are encapsulated masses with mixed intensity showing areas of fat intensity.

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Diagnosis and Management

Hamartoma

- Abnormal proliferation of the normal benign breast tissue within a thin connective tissue capsule.
- Some cases associated with Cowden's syndrome.
- Typified by "breast within a breast" sign on mammography characterized by a well encapsulated mass containing mixed tissue and fat.
- Biopsy shows normal tissue which can be observed with or without pseudoangiomatous changes.

Pseudoangiomatous Stromal Hyperplasia (PASH)

- Benign proliferation myofibroblastic and stromal hyperplasia which can mimic a vascular lesion.
- Mammographic and ultrasound appearance is typically a solid circumscribed, non-calcified lesion.

Management of PASH and Hamartoma

- Hamartoma: Typically detected incidentally on screening mammogram, if asymptomatic can be safely observed and patient resume routine screening.
- PASH: Core needle biopsy is a final diagnosis and surgical excision is not required if the lesion is asymptomatic, has no suspicious features on imaging and there is no significant interval growth.

Management of Invasive Ductal Carcinoma

- Appropriate surgical and oncologic management

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