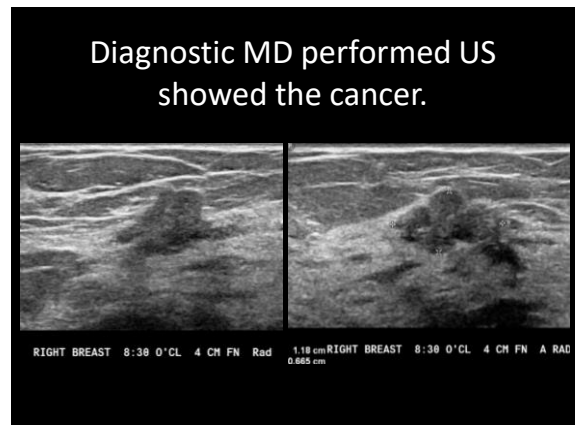
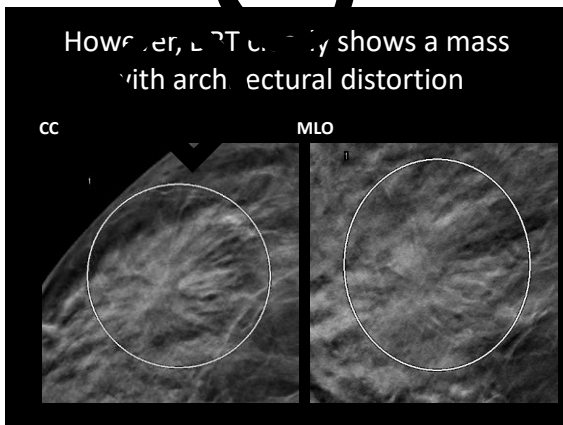
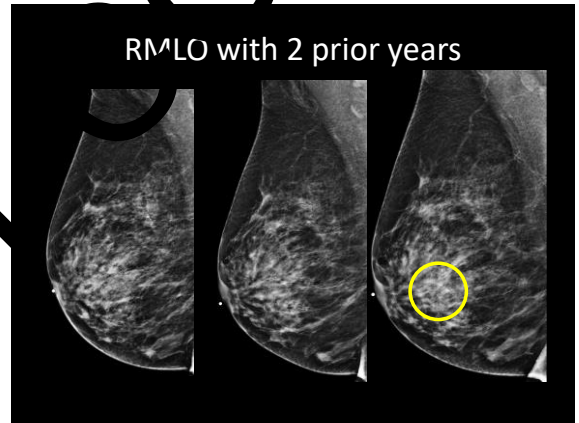
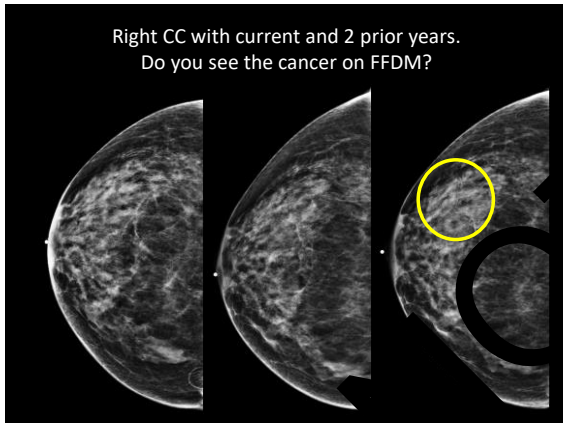


**Digital Breast Tomosynthesis
 for Diagnosis:
 A case-based approach**

Laurie Margolies, MD FSBI FACR
 Professor of Radiology
 Icahn School of Medicine at Mount Sinai
 System Chief Breast Imaging
 Mount Sinai Health System

Why we spend the time doing DBT.

- 69 year old
- High risk with strong family history
- Screening exam
- Teaching case
- There is a cancer in the Right Breast!





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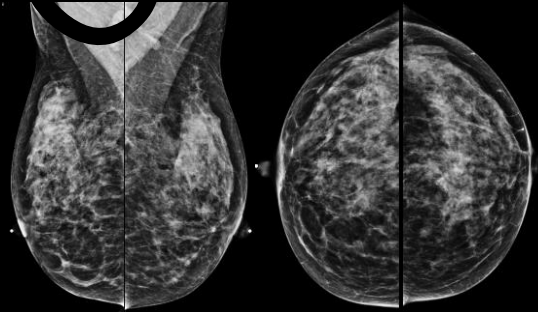
**FROM DBT DIRECTLY TO ULTRASOUND:
OFTEN SKIP THE ADDITIONAL VIEWS**

DBT Streamlines Work-up of Abnormal Screening Exams

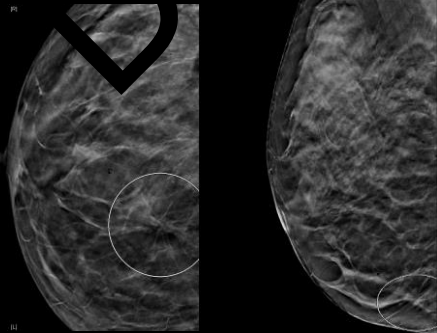
- Often additional mammogram views are not needed
 - 32% decrease in # of additional views
 - Can proceed directly to Ultrasound in many cases
 - 72% patients require no additional mammographic images
 - Caveat: Still need magnification views for calcifications
-
- Philpotts et al. RSNA abstract, 2013
 - Margolies et al. ISRN Radiology, 2014
 - Noroozian M, Radiology 262, pp 1158-1168, 2012.

**49 YEAR OLD – DBT DETECTED
CANCER**

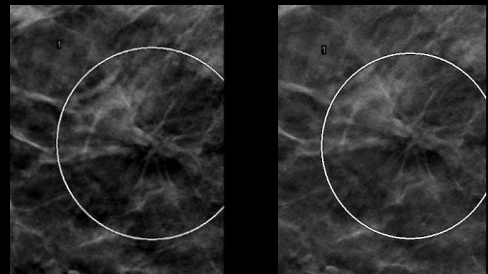
FFDM cancer cannot be found!

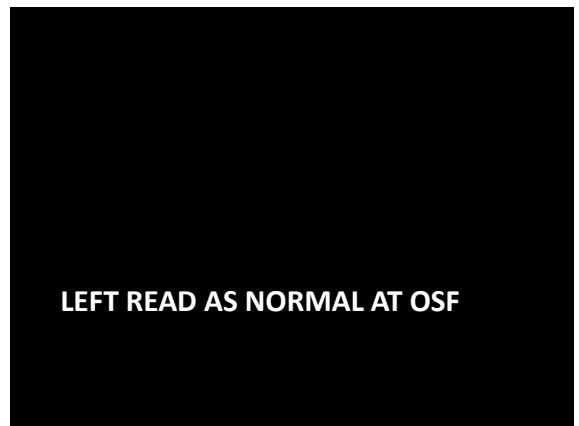
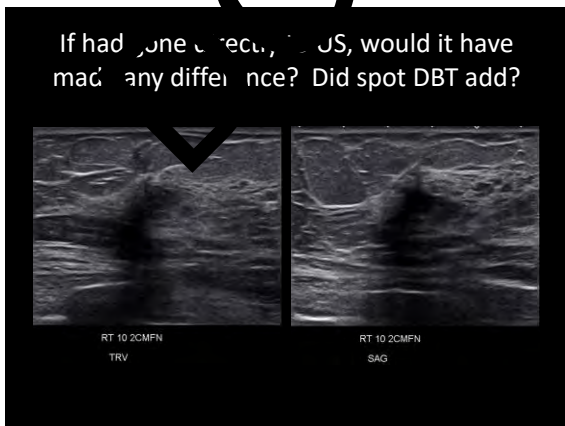
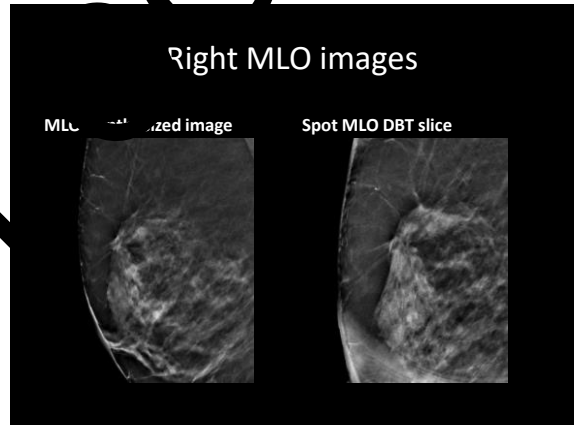
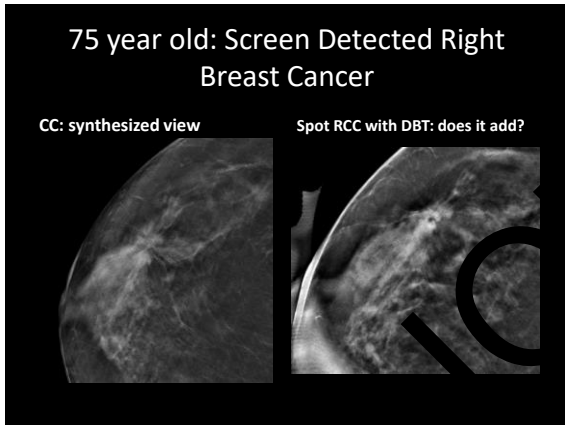
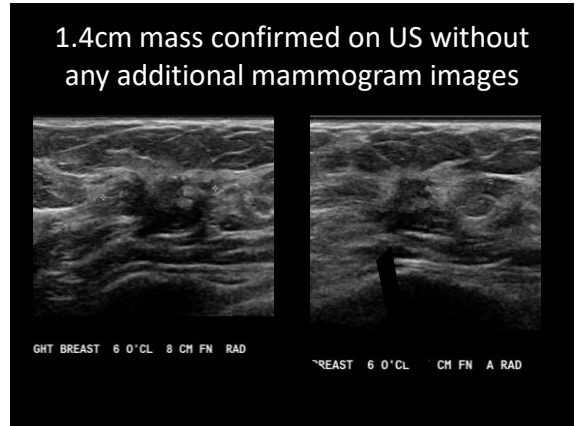
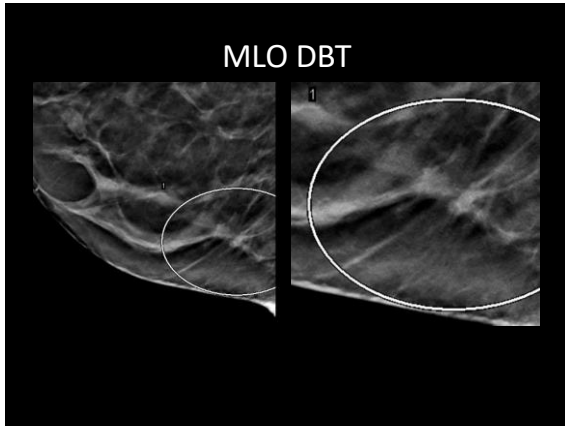


DBT



CC DBT

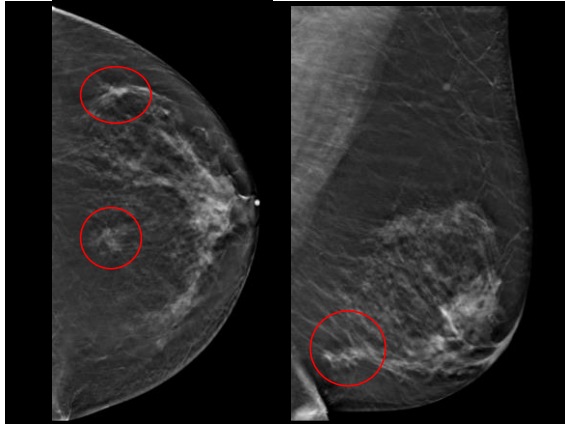






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She came for 2nd opinion and we asked for DBT spots

Left inferior MLO spot with DBT Left superior MLO spot with DBT

Do spots help? Confusing?

Left CC medial DBT spot Left CC lateral DBT spot

Left lateral 3:00 7 cm FN = IDC

Left Inferior medial = IDC

FFDM Screen is BI-RADS 0

Is DBT sufficient for work up or is spot compression needed?

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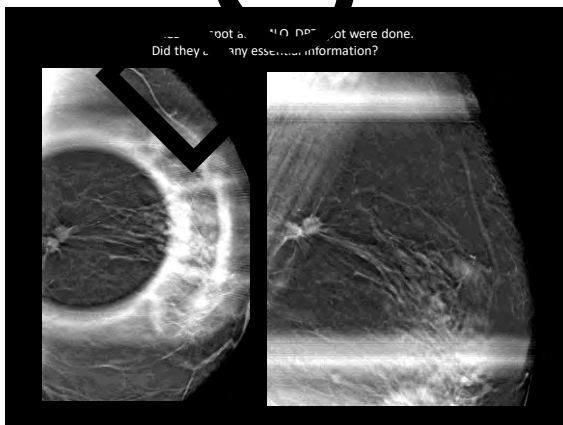
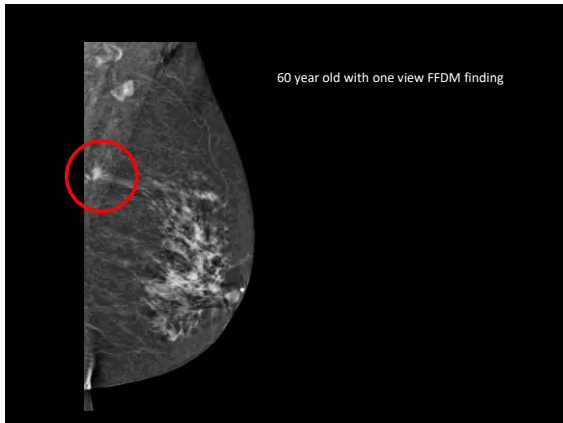
2017 Study: 548 FFDM screens were BI-RADS 0

- 341 lesions were assessed by both DBT and routine spots.
- Spots were better in **only** one patient because of a technical error on DBT exam.
- There was no asymmetry, distortion or mass where spot compression gave more diagnostic information.
- Conclusion: spots may be obsolete to evaluate masses, asymmetries and distortions where DBT is available.

Ni Mhuirheartaigh N et al. Breast J. 2017 Sep;23(5):509-518

Can digital breast tomosynthesis perform better than standard digital mammography work-up in breast cancer assessment clinic?

- Patients recalled from FFDM
- 80% of radiologists performed better with DBT than standard workup.
- Cancers appeared more severe and conspicuous on DBT.
- DBT reduced need for additional views and for ultrasound.
- Mall S, et al. Eur. Radiol. 2018 Dec;28(12):3400-3404





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Digital breast tomosynthesis is comparable to mammographic spot views for mass characterization.

- Four academic radiologists evaluated DBT images and spot compression images of 67 masses (30 malignant, 37 benign)
- Mean mass visibility ratings were slightly better with DBT

spots might not be necessary for mass characterization when performing DBT.

- Noroozian M, et al. Radiology. 2012 Jan; 262(1):61-8

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76 year old with a palpable cancer.

Which modality shows the margins better:
Focal spot compression or DBT?



**MAYBE SPOTS HELP THE US
TECHNOLOGISTS FIND THE MASSES**

Masses in the era of screening tomosynthesis: Is diagnostic ultrasound sufficient?

- A retrospective study of about 200 masses recalled from screening DBT
- About half had diagnostic mammograms first and half went directly to diagnostic US.
- There was no significant difference in ultrasound visibility of masses sent to diagnostic mammography first with those sent to ultrasound first.
- 98% of DBT screen-detected masses sent to ultrasound directly were adequately assessed without diagnostic mammography.
- Choudhery S, et. al. Br J Radiol. 2019.

**IF YOU SKIP THE LATERAL NEED TO
UNDERSTAND THE SCROLL BAR**

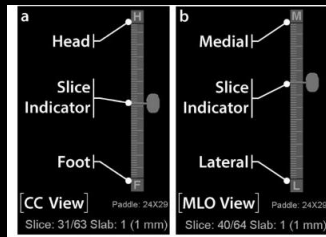
The scroll bar is often not accurate!





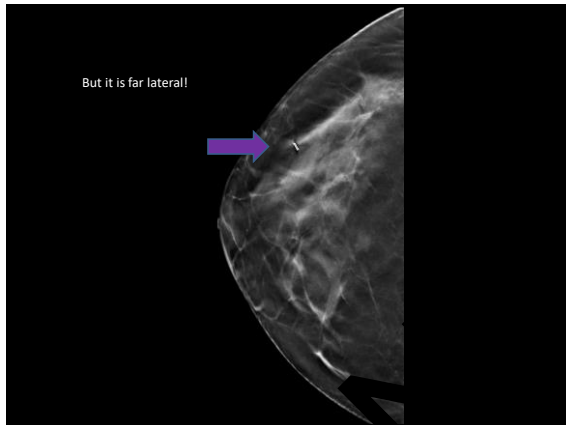
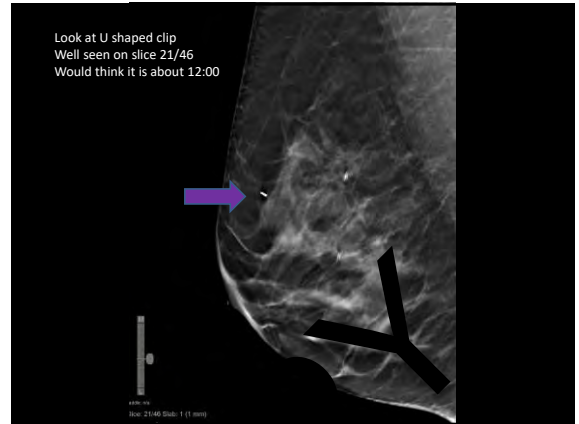
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The scroll bar is often not accurate!

Friedewald, et al. Lesion localization using the scroll bar on tomosynthesis: Why doesn't it always work?, In Clinical Imaging, Volume 47, 2018, Pages 57-64



Why is scroll bar not always accurate?

1. On the CC view, the scroll bar predicts location on lateral image not on MLO.
2. Lateral lesions will be lower on scroll bar and medial lesions higher.
3. The more peripheral the greater the difference between MLO and lateral images.

Friedewald, et al. Lesion localization using the scroll bar on tomosynthesis: Why doesn't it always work?, In Clinical Imaging, Volume 47, 2018, Pages 57-64

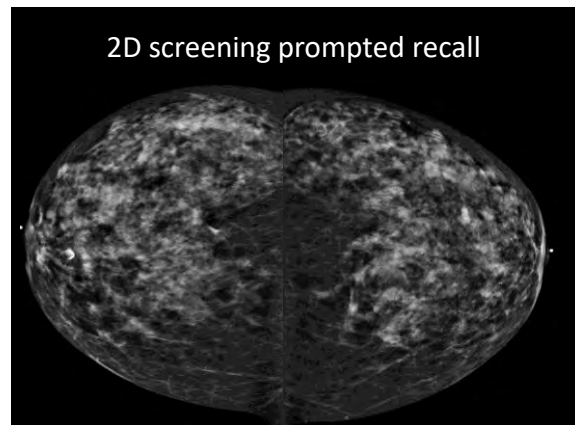


Why is scroll bar not always accurate?

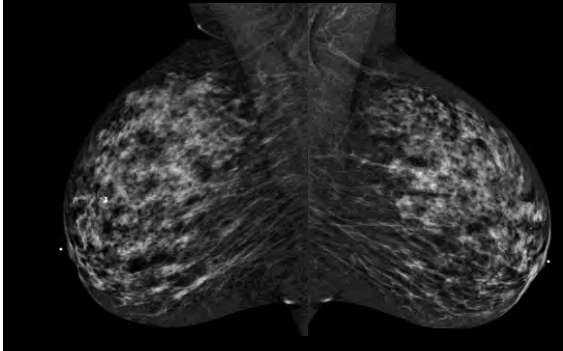
The center of the breast is often not at the center of the scroll bar; the nipple is often not at the center slice.

Therefore, must use relationship to nipple not arbitrary scroll bar location.

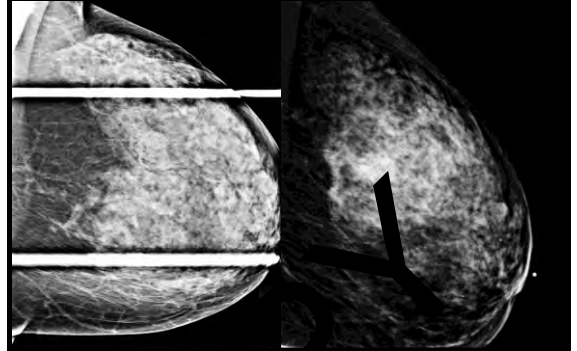
Friedewald, et al. Lesion localization using the scroll bar on tomosynthesis: Why doesn't it always work?, In Clinical Imaging, Volume 47, 2018, Pages 57-64



2D screening prompted recall



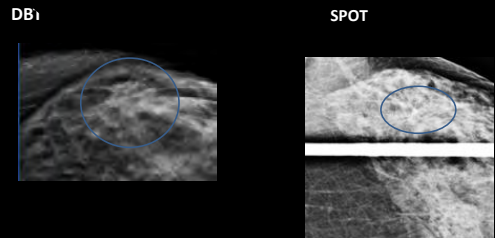
Lateral and Spot done when recalled



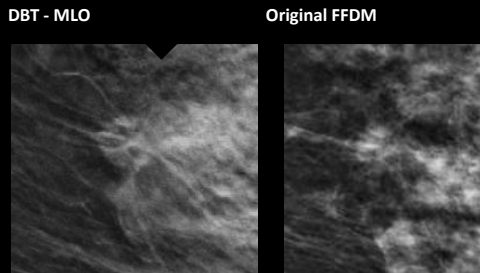
What would you do now?
More spots? BI-RADS 3?
Ultrasound?

We went to DBT.

DBT clearly spiculated mass; spot
paddle 'technologist had displaced
mass out of paddle.



DBT clearly abnormality



DBT advantages in this case

- 1. If DBT had been done primarily, the patient would not have been had additional views, but could have gone directly to ultrasound/ultrasound core
- 2. The spot and lateral were not conclusive/misleading while the DBT clearly showed the spiculated mass.

WHAT IF THE MASS IS CIRCUMSCRIBED
 ON SCREENING DBT?

**Are circumscribed masses better
 visualized and assured of being benign
 on DBT?**

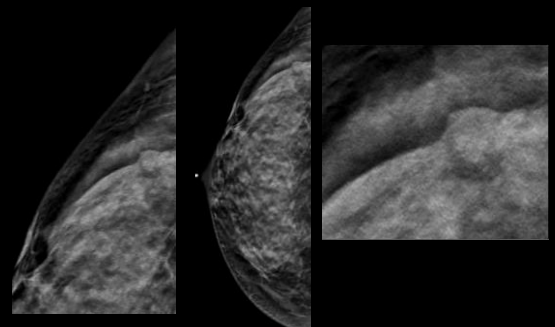
- Seventy-one circumscribed masses on DBT
 - 19 malignant (27% are malignant!)
 - 52 benign lesions
 - 27 histologically diagnosed
 - 25 cysts diagnosed by ultrasonography or MRI.

• **IMPORTANT TO REMEMBER – CIRCUMSCRIBED DOES NOT
 EQUAL BENIGN ON DBT!**

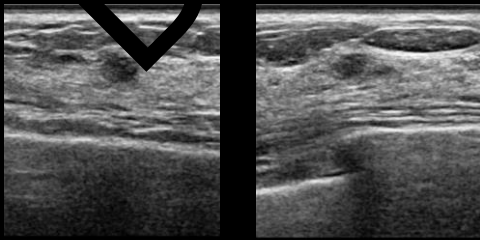
Nakashima K, et al. Eur Radiol. 2017 Feb;27(2): 573-577

Cancers can be circumscribed

Synthesized and DBT Slice show an
 isodense circumscribed mass

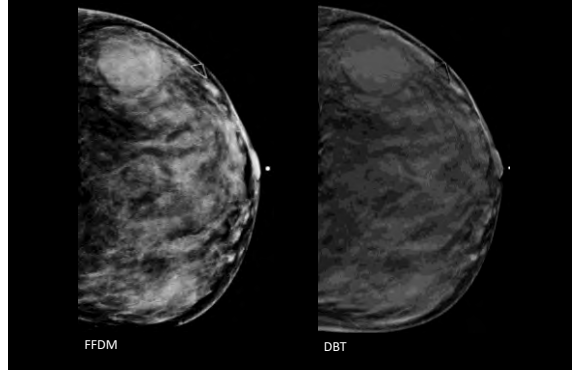


MCNB = IDC

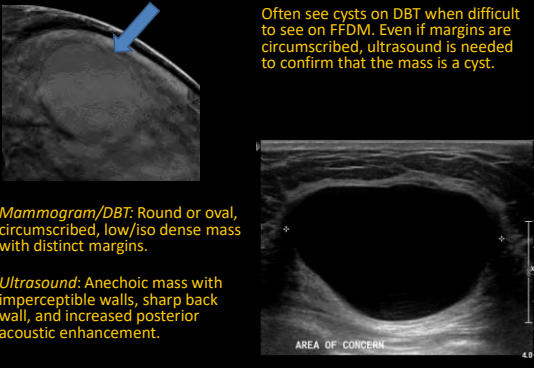


EAST 9 0°CL 5 CM FN RAD | EAST 9 0°CL 5 CM FN A RAD

Palpable mass



Cyst



Often see cysts on DBT when difficult to see on FFDM. Even if margins are circumscribed, ultrasound is needed to confirm that the mass is a cyst.

Mammogram/DBT: Round or oval, circumscribed, low/iso dense mass with distinct margins.

Ultrasound: Anechoic mass with imperceptible walls, sharp back wall, and increased posterior acoustic enhancement.

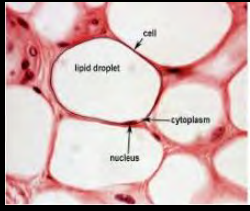
Cancers can have fat within

With DBT will see more masses that have fat in them.

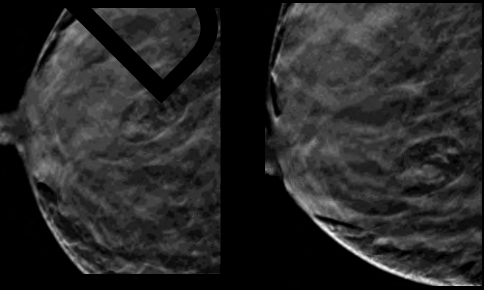
- Fat is NOT always a benign finding - malignant breast masses can contain entrapped fat.
- Therefore, if the shape and/or margins are suspicious the presence of fat should not deter biopsy.

Digital Breast Tomosynthesis in the Analysis of Fat-containing Lesions
Phoebe E. Freer, Jessica L. Wang, and Elizabeth A. Rafferty
RadioGraphics 2014 34:2, 343-358

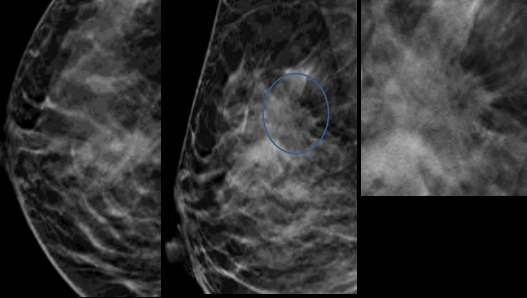
- fat is common in benign and malignant breast masses and DBT, even when no fat is appreciated at FFDM mammography.
- Presence of encapsulated fat-containing masses (lipoma, hamartoma, galactocele, lipid cyst) the masses are benign



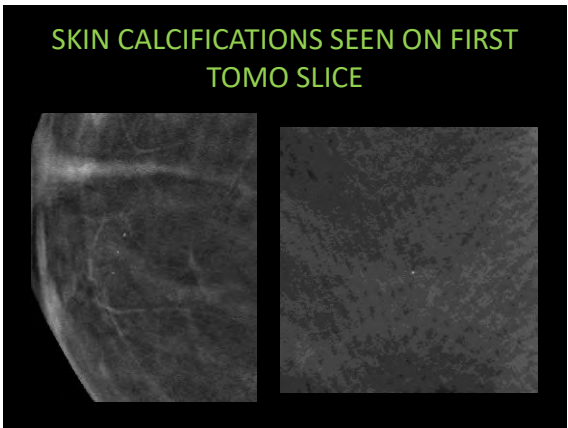
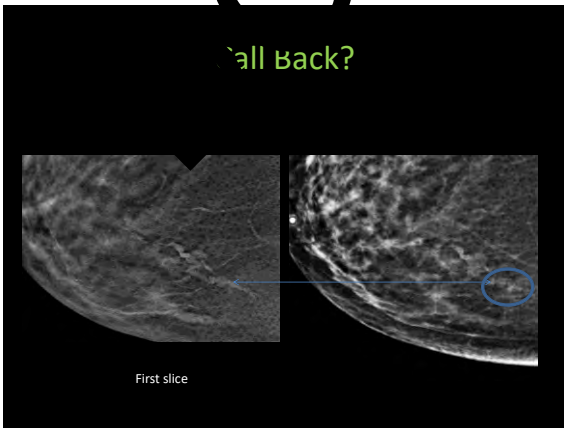
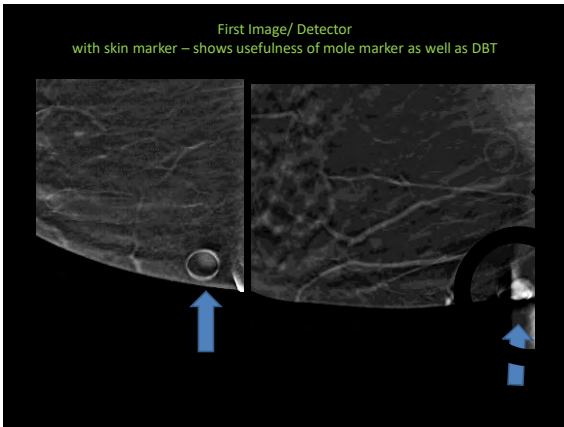
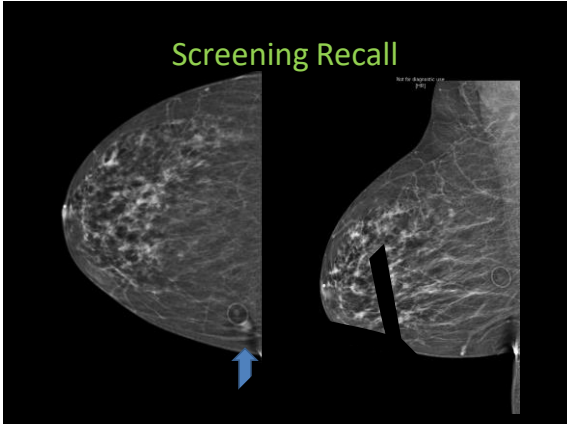
Hamartoma

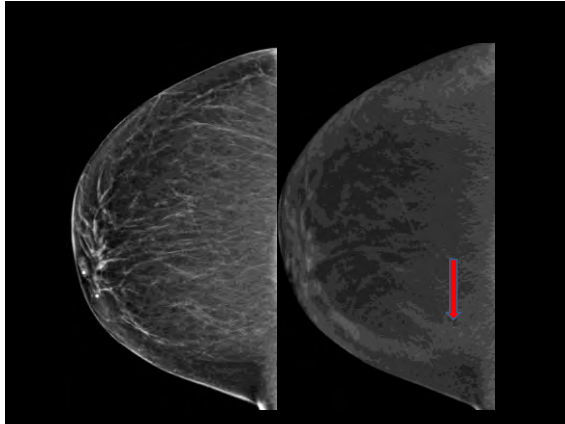


Cancer containing fat



DBT CAN BE HELPFUL FOR SKIN MASSES
 AS WELL AS SKIN CALCIFICATION





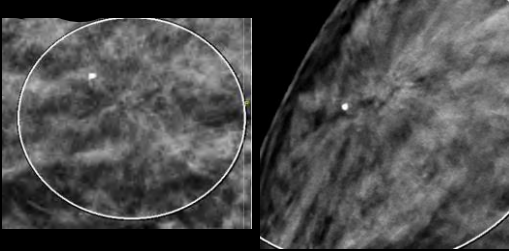
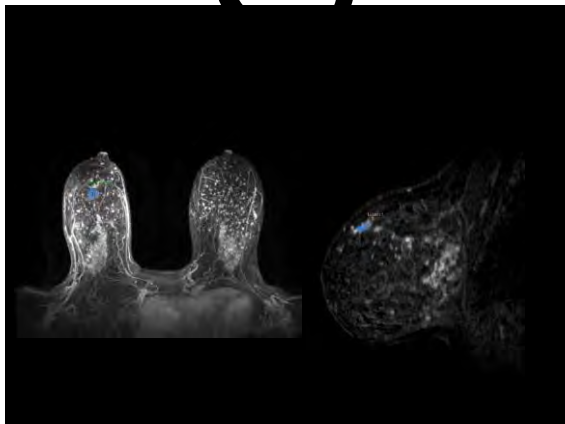
Architectural distortion: FFDM vs. DBT

Retrospective review of architectural distortion **recommended** for biopsy

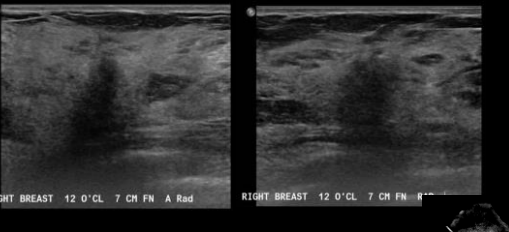
- ✓ Architectural distortion more common on DBT than FFDM (0.14% vs 0.07%).
- ✓ The positive predictive value of architectural distortion is lower on DBT than FFDM: 50.7% vs 73.6%.
- ✓ Radial scar was the most common nonmalignant finding in both groups, but is more common on DBT (33.2% vs 17.5%).
- ✓ In the DBT group, architectural distortion with US correlate is more likely to be cancer (66.5% vs 29.2%). Biopsy is warranted even in the absence of a sonographic correlate given the nearly 30% risk of cancer.

Bali M, et al. Pathologic Outcomes of Architectural Distortion on Digital 2D Versus Tomosynthesis Mammography. ACR, 2019.

42 year old with AD on screening DBT

US and MRI correlates: was sure this was a cancer, but pathology = radial scar





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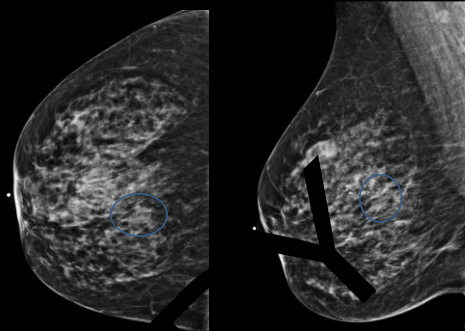
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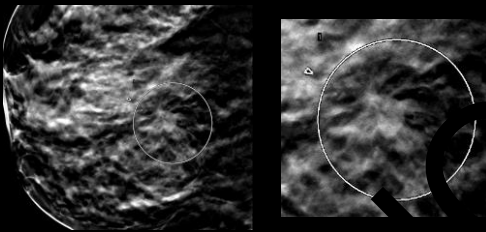
Prior benign biopsy

60 YEAR OLD PRESENTS FOR SCREENING

A Cancer will be found in this breast!

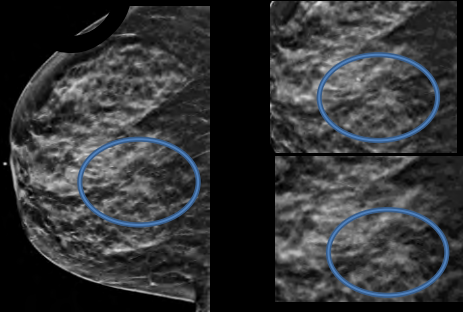


RCC – DBT images



AD CN SM

AD ON TOMO



This is a 2 cm infiltrating tubulo-lobular cancer.





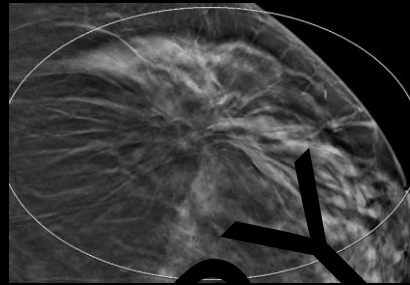
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Very important to have history and scar markers

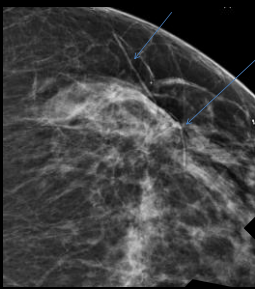
SCARS CAN BE PROMINENT ON DBT

Architectural Distortion: Scar Cancer?



Note that there is no artifact from the scar marker!

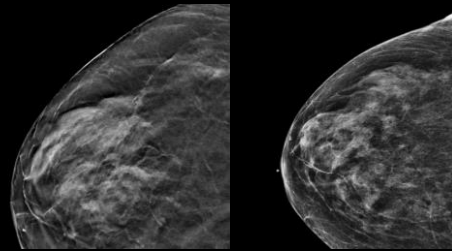
Scar was marked so we can be confident this is scar



DBT, scar or normal?

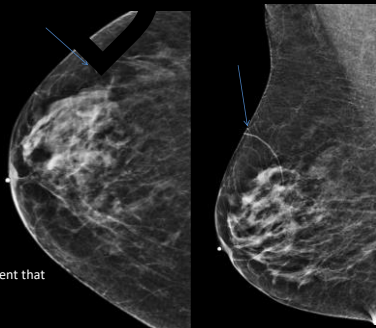
DBT

FFDM



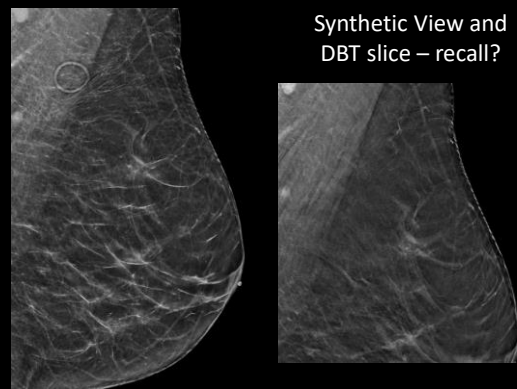
There is no scar marked. What is your next step?

2 years earlier scar was marked!



Now confident that this is scar.

Synthetic View and DBT slice – recall?

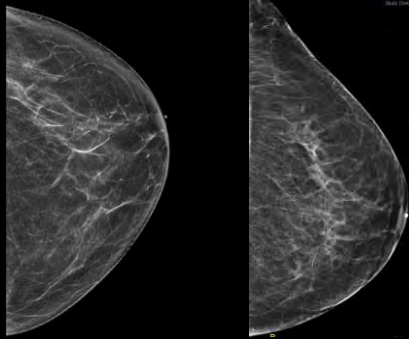




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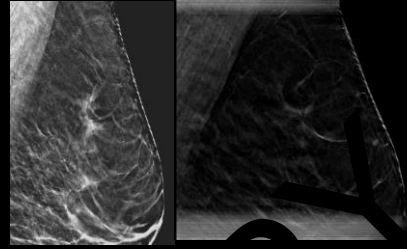
CC: Synthesized and FFDM XCCL



Now, read as BI-RADS 2

Slice from Lateral DBT

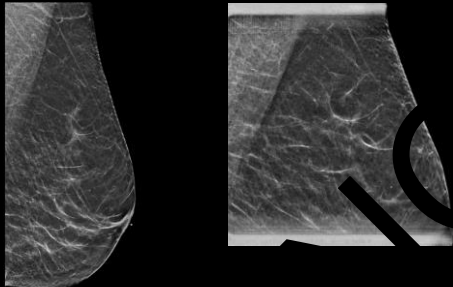
Slice from MLO spot



BI-RADS 2: no US correlate

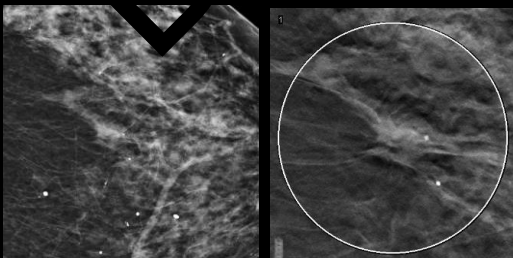
LM Synthesized

Synthesized-View MLO spot

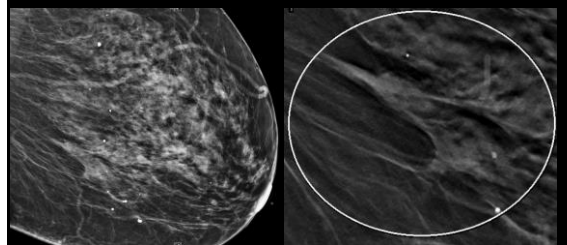


DBT DETECTED CANCERS CAN BE ONE VIEW FINDINGS

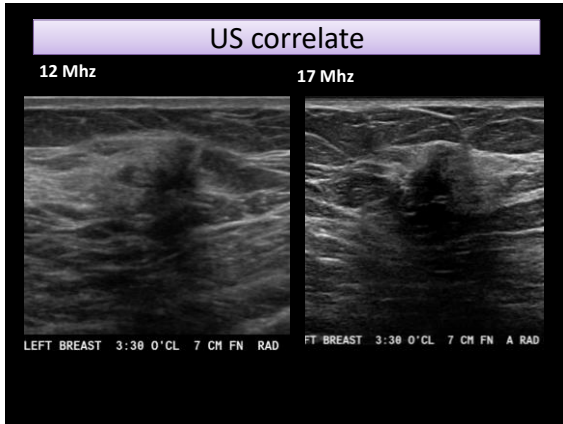
CC IMAGES: Developing Asymmetry



MLO: prospectively easy miss



MAYBE THIS IS THE CORRELATE TO THE CC FINDING



One view only findings: MD Anderson Experience

- Screening DBT exams less likely to be recalled for one-view-only findings: (1.4 vs. 3.1%)
- But when worked up more likely to be abnormal and more cancers found:
 - 5.3% of FFDM became BI-RAD 4/5 vs. 10.5% of DBT

Cohen, et al. AJR:211: 445-451, August 2018

DBT One view only Cancer findings: MD Anderson Experience

- CC or MLO: 50/50 (although more recalled on MLO)
- 86% asymmetries
- 14% distortion
- PPV of DBT one-view-only findings = 4.0% vs. 1.8% for FFDM

Cohen, et al. AJR:211: 445-451, August 2018

DBT FOR PALPABLE MASSES

84 year old: palpable marker – but the large cancers are not seen on the MLO DBT

Cleavage view and US show cancers

RIGHT BREAST 4 0°CL 12 CM FN A RAD GRT BREAST 8 0°CL 3 CM FN RAD



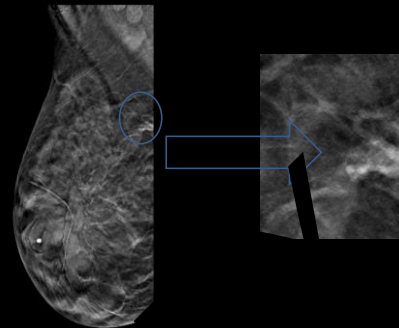
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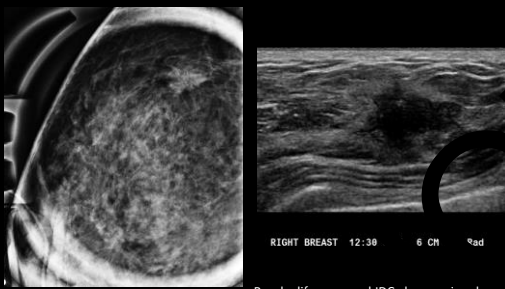
DBT positioning can be difficult but is as important as ever

- Paddles are generally larger; some manufacturer's detectors are larger than others
- If tissue is not on image, a cancer can be missed

Cancer is at the edge of the image!



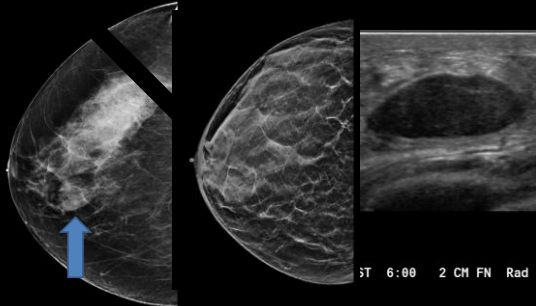
Prospectively seen only when mags done for some calcifications! Then US done.



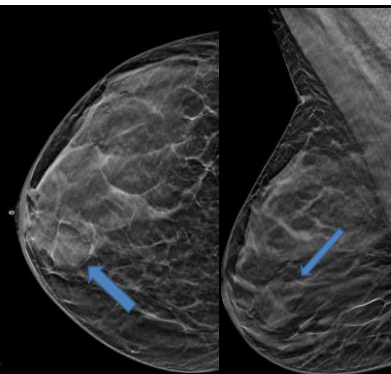
Poorly defined mass almost missed as
Only partly seen at very edge of image!
Lucky mags were done or would have missed

**LARGE MASSES CAN BE OBSCURED
AND NOT SEEN ON DBT**

Hard to see masses with weight loss



DBT slices





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