Ministério da Saúde
Instituto Nacional de Câncer
Coordenação de Ensino
Curso de Aperfeiçoamento nos Moldes Fellow em Radiologia Mamária

GIOVANA ORTIZ D'ÁVILA

UNCOVERING FALSE POSITIVE LESIONS THROUGH DIGITAL BREAST TOMOSYNTHESIS

Rio de Janeiro
2024

GIOVANA ORTIZ D'ÁVILA

UNCOVERING FALSE POSITIVE LESIONS THROUGH DIGITAL BREAST TOMOSYNTHESIS

Trabalho de Conclusão de Curso apresentado ao Instituto Nacional de Câncer como requisito parcial para a conclusão do Curso de Aperfeiçoamento nos moldes Fellow em Radiologia Mamária.

Orientadora: Profª. Dra. Érica Endo

Revisora: Profª. Dra. Shirley Burburan

Rio de Janeiro

2024

CATALOGAÇÃO NA FONTE
INCA/COENS/SEITEC/NSIB
Kátia Simões CRB7/5952

D259u D'Ávila, Giovana Ortiz.
Uncovering false positive lesions through digital breast tomosynthesis. / Giovana Ortiz D'Ávila. – Rio de Janeiro, 2024.
33 f.: il. color.

Trabalho de Conclusão de Curso (Aperfeiçoamento) - Instituto Nacional de Câncer, Programa de Aperfeiçoamento nos Moldes de Fellow em Radiologia Mamária, Rio de Janeiro, 2024.

Orientador: Profª. Drª. Érica Endo.
Revisora: Profª Drª Shirley Burburan.

1. tomossíntese mamária digital. 2. mamografia. 3. radiologia mamária. 4. lesões falso-positivas. 5. BI-RADS. I. Endo, Érica. (Orient.). II. Burburan, Shirley. (Rev.). III. Instituto Nacional de Câncer. IV. Título.

CDD 616.075 7

GIOVANA ORTIZ D'ÁVILA

Uncovering false positive lesions through digital breast tomosynthesis

Trabalho de Conclusão de Curso apresentado ao Instituto Nacional de Câncer como requisito parcial para a conclusão do Curso de Aperfeiçoamento nos moldes Fellow em Radiologia Mamária.

Aprovado em: 29 de fevereiro de 2024.

Banca examinadora:

Dra. Thaís S Monnerat
CRM-RJ 52 104096-7
Médica

Dra. Thaís Salgado Monnerat

Dra. Marcele F. Barreto Côrtes
Médica Radiologista
CRM 52 718274-0

Dra. Marcele França Barreto Côrtes

PAULA MEDINA
RADIOLOGISTA

Dra. Paula Medina Maciel Gomes Curi Bonotto

Dra Érica Endo
Médica
CRM-RJ 5754-6/R

Profª. Dra. Érica Endo

Rio de Janeiro

2024

RESUMO

D'ÁVILA, Giovana Ortiz. **Descobrindo lesões falso-positivas através da tomossíntese mamária digital.** Trabalho de Conclusão de Curso (Aperfeiçoamento nos Moldes Fellow em Radiologia Mamária) — Instituto Nacional de Câncer (INCA), Rio de Janeiro, 2024.

Esta apresentação tem como objetivo demonstrar o potencial da tomossíntese mamária digital na melhoria da assetividade diagnóstica. A tomossíntese gera uma reconstrução tridimensional de imagens em diferentes ângulos através do movimento do arco do tubo de raio- e está em processo de substituir a mamografia digital como modalidade de imagem prefencial na mamografia de rastreamento. Entre as vantagens da tomossíntese mamária digital estão: reduzir a sobreposição de tecidos e a reconvocação da paciente, aumentar a detecção de câncer, melhorar a caracterização e localização de lesões e tem dose de radiação equivalente em comparação com a mamografia digital. Através de casos ilustrativos do Instituto Nacional do Câncer, demonstramos alguns pontos de ensino: os primeiros seis cortes das imagens de tomossíntese mostram lesões que estão na pele; a avaliação eficiente do contorno pela tomossíntese melhora a identificação e caracterização da ectasia ductal reduzindo a influência da sobreposição de tecido, pode auxiliar na distinção entre linfonodos suspeitos e não suspeitos, pode auxiliar na diferenciação entre calcificações vasculares e calcificações grosseiras com distribuição linear próximas a um vaso, assimetrias focais podem ser confirmadas ou descartadas na tomossíntese; e combinada com a mamografia 2D no rastreamento do câncer de mama pode reduzir atrasos no diagnóstico, melhorando a detecção do câncer e ao mesmo tempo, diminuindo a taxa de falsos positivos.

Palavras-chave: tomossíntese mamária digital; mamografia; radiologia mamária; lesões falso-positivas; BI-RADS.

ABSTRACT

D'ÁVILA, Giovana Ortiz. **Uncovering false positive lesions through digital breast tomosynthesis.** Final paper. (Fellowship in Breast Imaging Radiology) — Brazilian National Cancer Institute (INCA), Rio de Janeiro, 2024.

This presentation aims to demonstrate the potential of digital breast tomosynthesis in improving the confidence for diagnosis. Tomosynthesis generates a three-dimensional reconstruction of images at different angles through the movement of the arc of the X-ray tube and is in the process of replacing digital mammography as the preferred imaging modality in screening mammography. Among the advantages of digital breast tomosynthesis are: reduce tissue overlap and patient recall, increase cancer detection, improve characterization, and localization of lesions and equivalent radiation dose compared with digital mammography. Through illustrative Brazilian Nacional Cancer Institute cases, we demonstrate some teaching points: the first six slices of the tomosynthesis images show skin lesions; efficient contour assessment by tomosynthesis enhances the identification and characterization of ductal ectasia by reducing the influence of over laying tissue; can aid in distinguishing between suspicious and non-suspicious lymph nodes; can help differentiate between vascular calcifications and gross calcifications with a linear distribution close to a vessel; focal asymmetries can be confirmed or ruled out in tomosynthesis; and combined with 2D mammography in breast cancer screening can reduce delays in breast cancer diagnosis, improving cancer detection while simultaneously lowering the false positive rate.

Keywords: digital breast tomosynthesis; mammography; breast radiology; false positive lesions; BI-RADS.

INSTITUTO NACIONAL DE CÂNCER

RSNA 2023
LEADING THROUGH CHANGE

UNCOVERING FALSE POSITIVE LESIONS THROUGH DIGITAL BREAST TOMOSYNTHESIS

G. O. D'Ávila, R. Morais, C. Fernandes Ramalho, M. F. Cortes, T. Salgado Monnerat, C. D. Figueiredo, A. Costa, P. M. Gomes, E. Endo

**The authors have no financial relationship with a commercial organization
that may have a direct or indirect interest in the content of this exhibit.**

LEARNING OBJECTIVES

- Recognize the **differences** between two dimensional (2D) mammography and digital breast tomosynthesis (DBT);

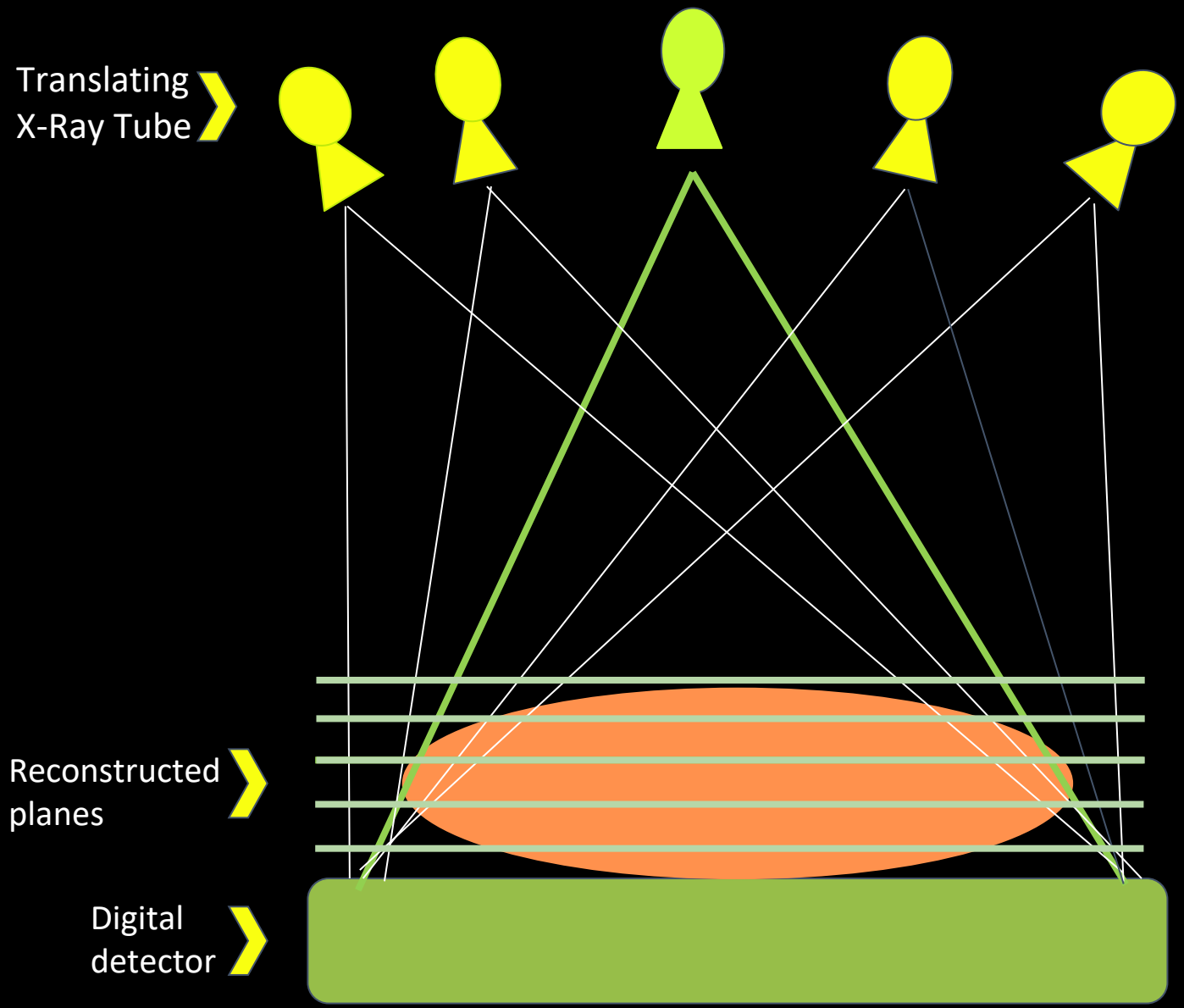
- Demonstrate the **potential of DBT** in improving the confidence for diagnosis;

- To provide **imaging examples** where digital breast tomosynthesis (3D) can help in the diagnosis of digital breast mammography (2D).

DBT CONCEPT

Digital breast tomosynthesis (DBT) generates a three-dimensional reconstruction of images in different angles through of arc movement X-ray tube.

Screening mammography using DBT is replacing digital mammography as the preferred imaging modality and is rapidly being implemented.



Conant, et al. Mammographic Screening in Routine Practice: Multisite Study of Digital Breast Tomosynthesis and Digital Mammography Screenings. Radiology, 307:3.

DBT CONCEPT

These 3D image sets help to reduce tissue overlap, which can disguise malignant growths or make it difficult to distinguish between normal overlapping breast tissue and cancer.

DBT necessitates a two-dimensional (2D) image for comparison with past mammograms and precise calcification interpretation.

The 2D reconstruction of the tomosynthesis slice dataset, known as synthetic mammography (SM), has been created to replace FFDM.

Conant, et al. Mammographic Screening in Routine Practice: Multisite Study of Digital Breast Tomosynthesis and Digital Mammography Screenings. Radiology, 307:3.

DBT ADVANTAGES

- Reduce tissue overlap;
- Reduce patient recall;
- Increase cancer detection;
- Improve detection, characterization, and localization of lesions;
- Equivalent radiation dose compared with digital mammography.

Conant, et al. Mammographic Screening in Routine Practice: Multisite Study of Digital Breast Tomosynthesis and Digital Mammography Screenings. Radiology, 307:3.
Skaane, et al. Comparison of Digital Mammography Alone and Digital Mammography Plus Tomosynthesis in a Population-based Screening Program. Radiology, 2013, 267:1.

FALSE-POSITIVE CONCEPT

Occurs when an image appears to show an abnormality, but further testing reveals that there is no actual abnormality present.

False positives are a common problem in medical imaging, particularly in mammography.

Coarse heterogeneous calcifications?

61-year-old woman.
Diagnostic mammography for reevaluation of suspicious calcifications in the left breast.

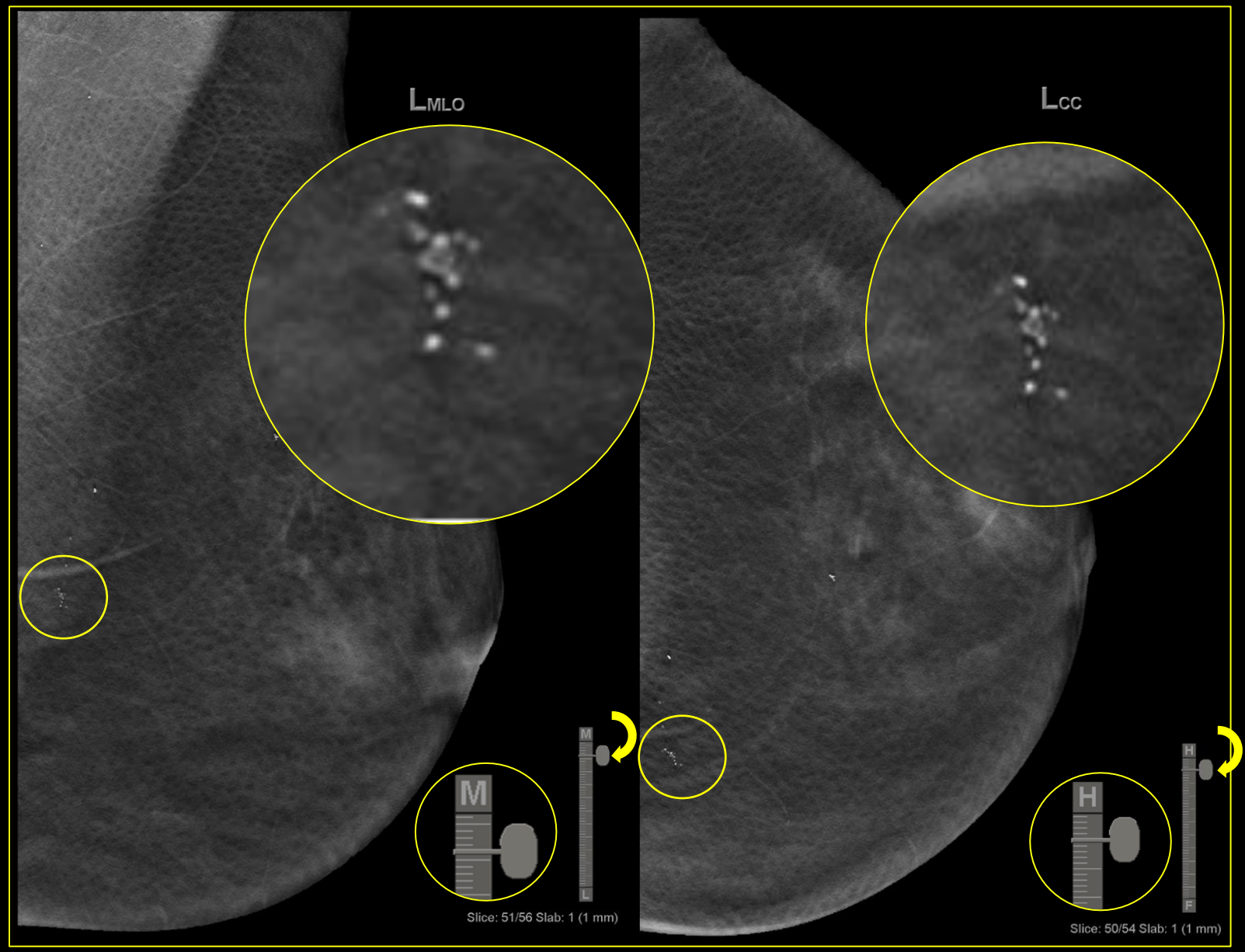
2D mammography showed a **coarse heterogeneous and linear distribution** (circle) in the lower medial quadrant of the left breast, classified in another institution as ACR BI-RADS™ 4.

Coarse heterogeneous calcifications?

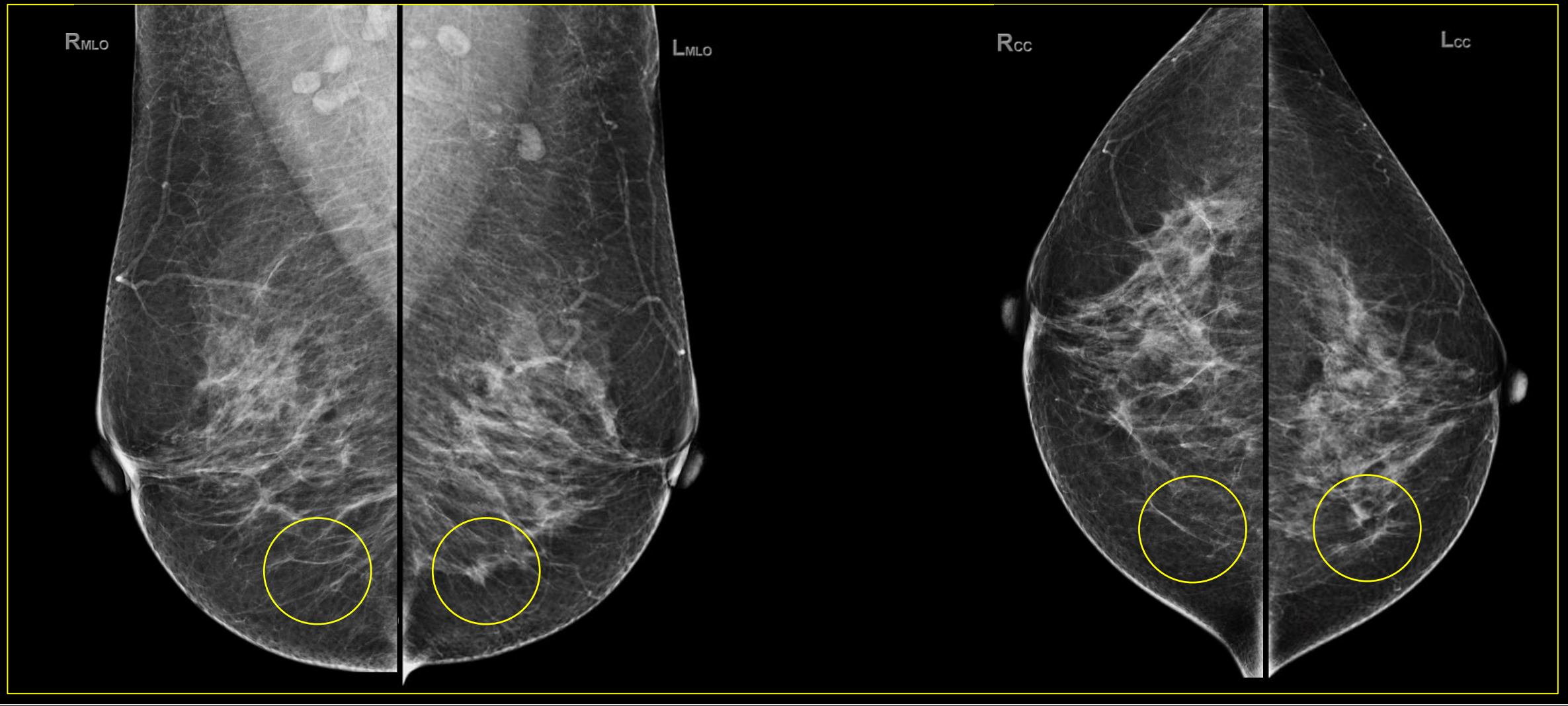
Teaching Point

The first six slices of the DBT images show skin lesions (no need for tangents).

The calcifications previously recognized by another institution and classified as suspicious were identified as **cutaneous calcifications** (circle) in the initial tomosynthesis slices and reclassified as ACR BI-RADS™ 2, avoiding an unnecessary biopsy.



Focal asymmetry?



58-year-old woman. A diagnostic mammogram from another institution described a focal asymmetry ACR BI-RADS™ 3 (circle).

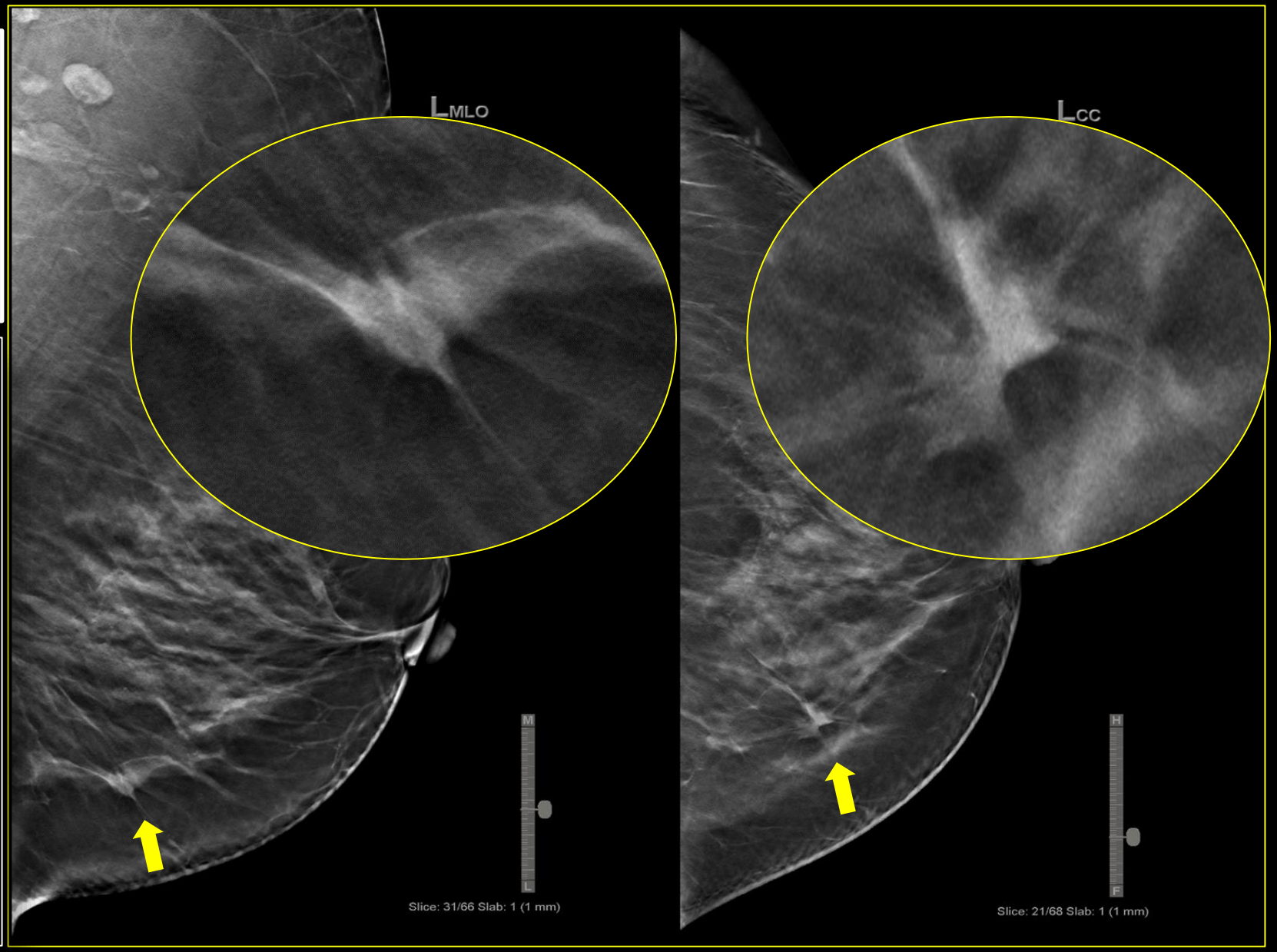
Focal asymmetry?

Teaching point

Efficient contour assessment by tomosynthesis reduces recalls.

DBT shows a **dense, irregular, spiculated mass** (arrow) in the middle third of the union of the lower quadrants of the left breast, ACR BI-RADS™ 4C.

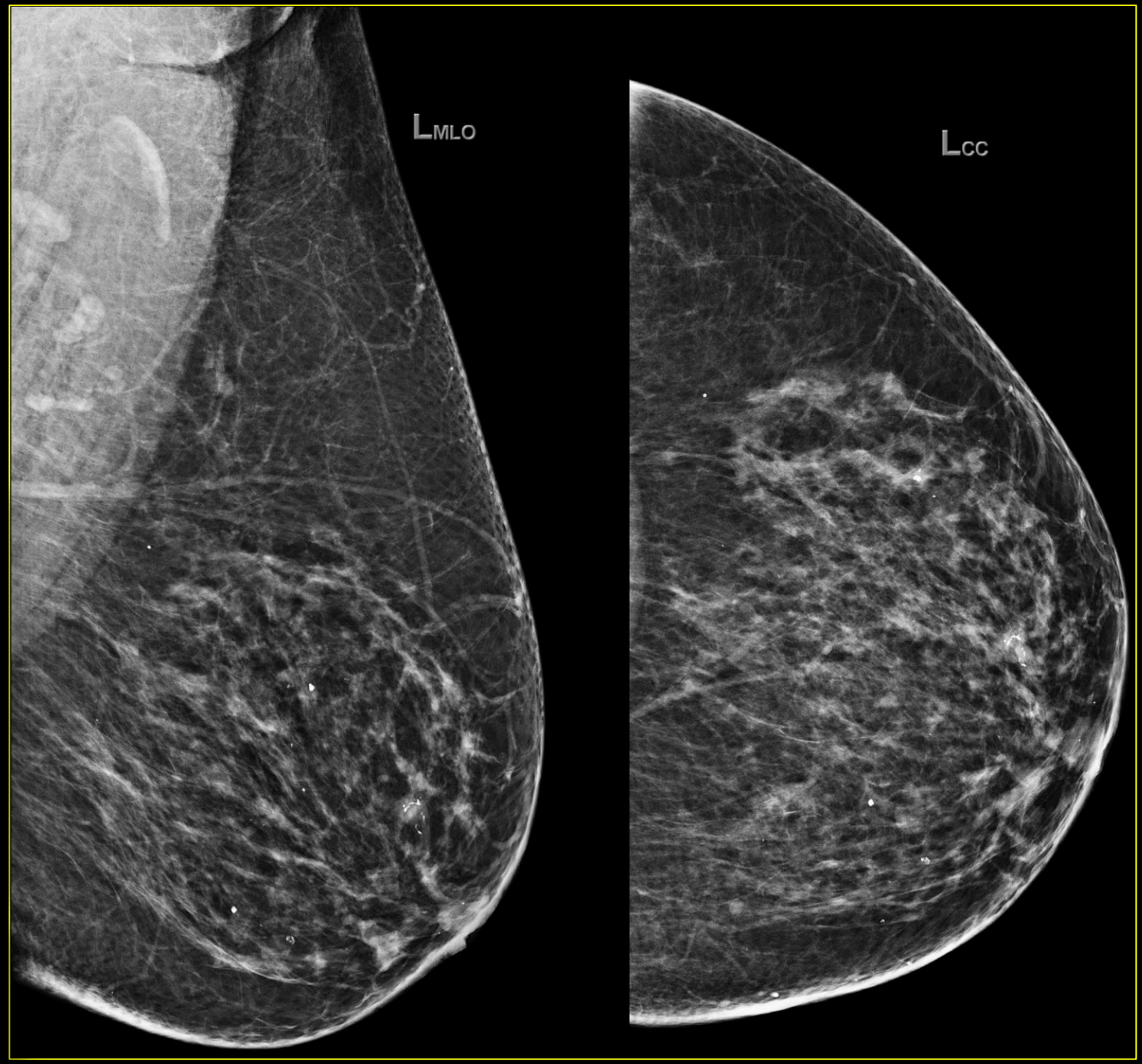
Pathology: Invasive breast carcinoma of no special type (IBC-NST) grade I, subtype luminal A.



Ductal ectasia?

63 year old woman. Diagnostic mammogram performed on a patient complaining of bloody papillary flow in the left breast.

2D mammography of the left breast.

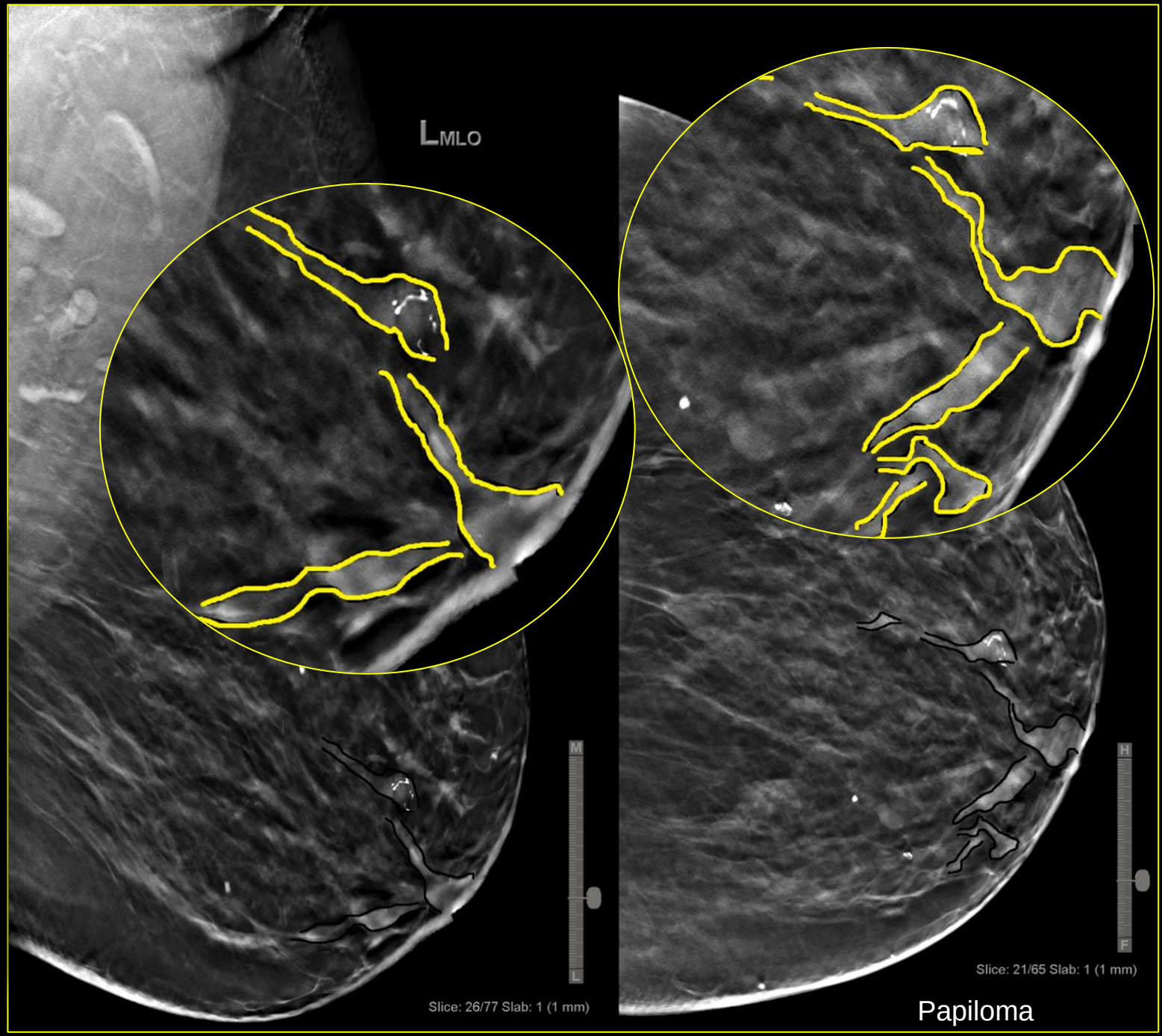


Ductal ectasia?

Teaching point

Breast tomosynthesis enhances the identification and characterization of ductal ectasia by reducing the influence of over laying tissue.

In this case, intraductal masses with calcifications were observed. Further ultrasound examination confirmed the presence of an **intraductal mass with ductal dilation** and classified as ACR BI-RADS™ 4A.



Papiloma

Left axillary lymphadenopaty?

Teaching point

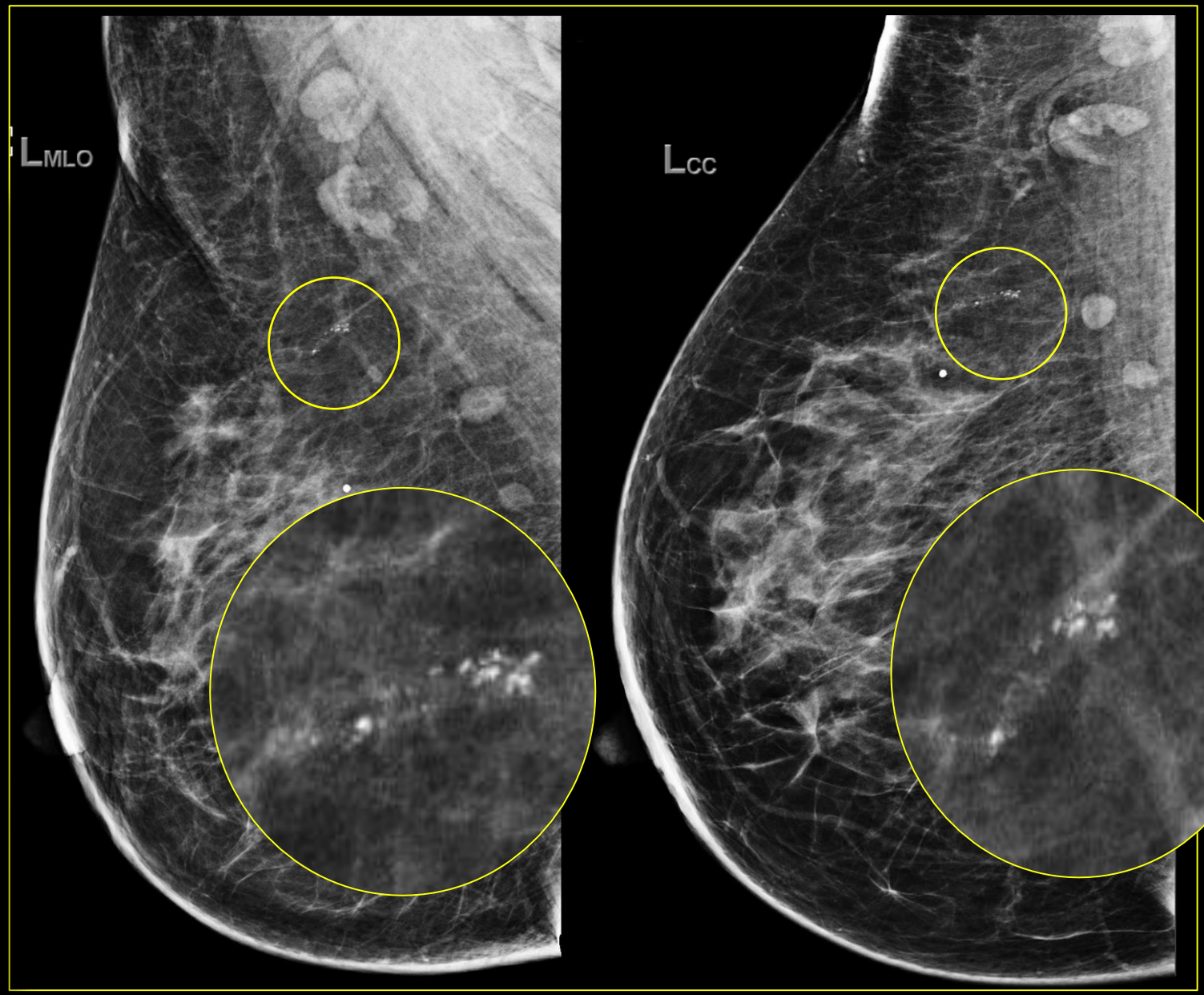
The use of tomosynthesis in the evaluation of lymph nodes on mammography can aid in distinguishing between suspicious and non-suspicious lymph nodes.

2D mammography shows the left axilla with apparent lymph node **cortical thickening** (arrow). DBT shows two overlapping lymph nodes, with **fatty hilum** (arrow head), typically benign appearance – ACR BI-RADS™ 2). Axillary ultrasound is unnecessary.

Linear distribution calcifications?

Diagnostic mammography for reevaluation of suspicious calcifications in the right breast referred by another institution.

2D mammography of the right breast reveals coarse heterogeneous and linear distribution (circle), classified in another institution as ACR BI-RADS™ 4.



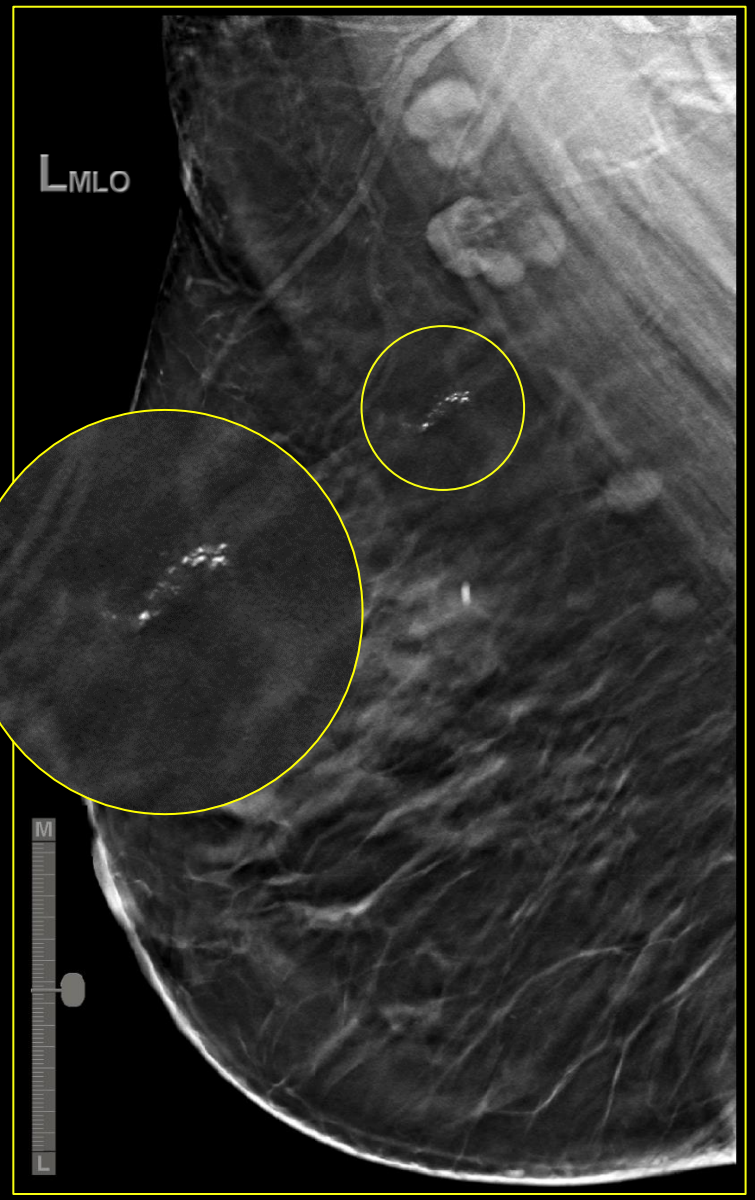
Linear distribution calcifications?

Teaching point

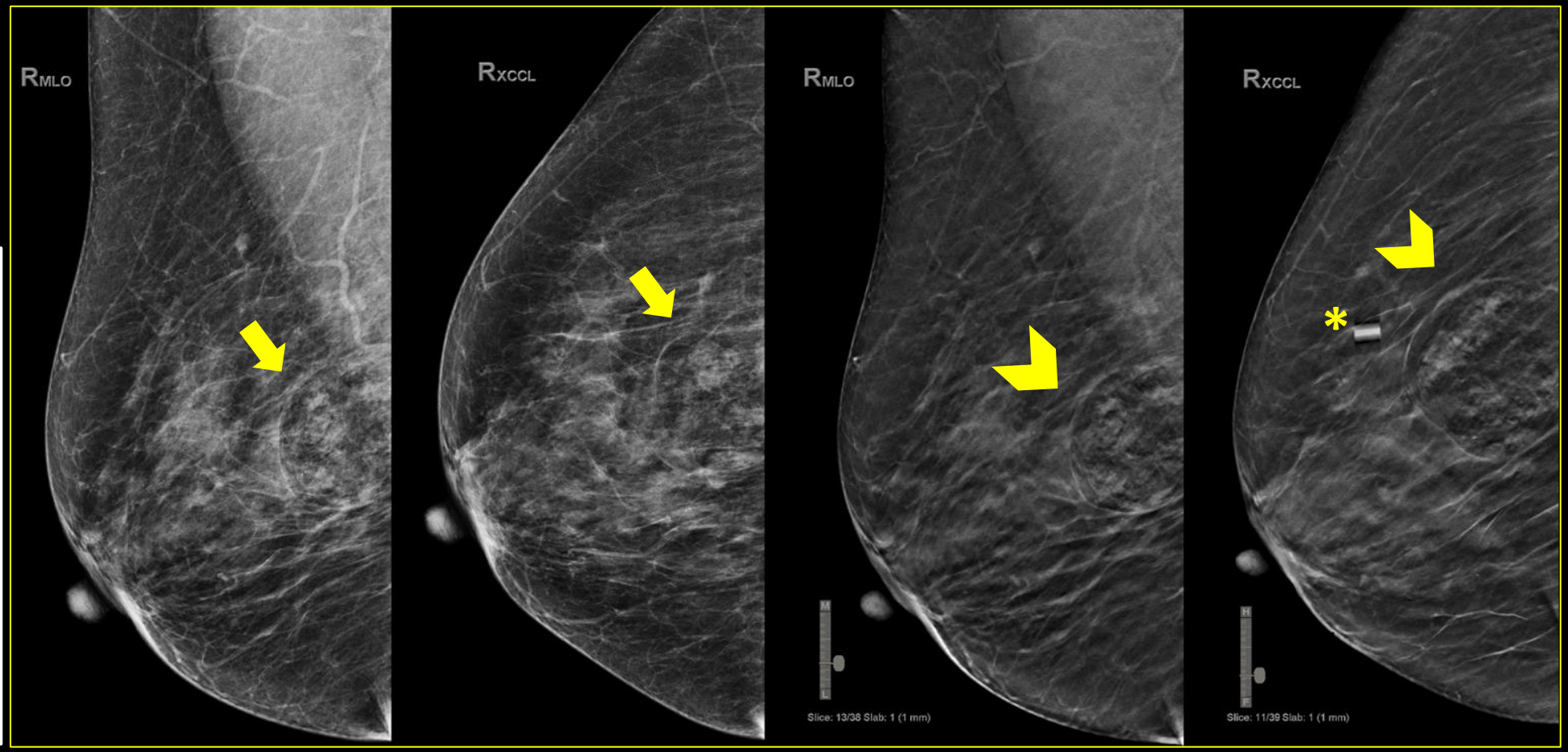
Tomosynthesis can aid in the identification of vascular calcifications in coarse calcifications with a linear distribution and near a vessel.

Vascular calcifications (circle).

DBT image shows discontinuous linear, parallel calcification located in a tubular structure (blood vessel), typically benign, ACR BI-RADS™ 2, excluding tissue diagnosis.



Palpable finding



Teaching point

Focal asymmetries can be confirmed or ruled out as images in tomosynthesis. Not infrequently, focal asymmetries can be defined as hamartomas.

Mammography from another institution attributed the palpation to **focal asymmetry** in the right breast ACR BI-RADS™ 3 (yellow arrow). Tomosynthesis shows an oval, mixed-density mass with pseudocapsule (arrow) better characterized on DBT images (yellow arrow head), compatible with **hamartoma**, indicated by BB (asterix) as the palpable area by the patient in the exaggerated craniocaudal view, ACR BI-RADS™ 2.

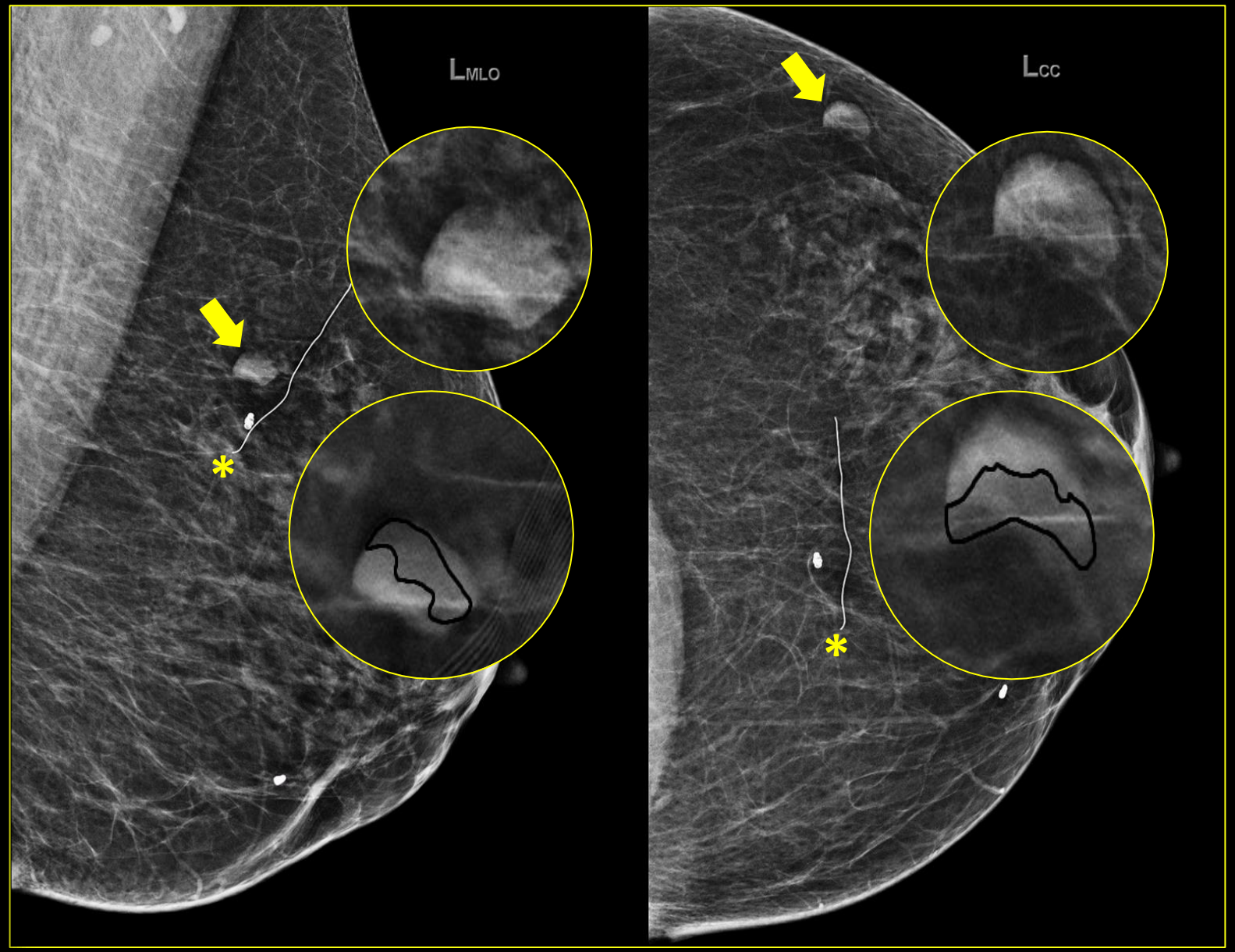
Solid mass?

Teaching point

Tomosynthesis improves the reniform shape and hilar fat detection by decreasing the impact of over lying tissue.

2D mammography images show an oval mass (arrow) in the upper lateral quadrant of the left breast. DBT shows reniform shape and hilar fat, characterizing an **intramammary lymph node** (ACR BI-RADS™ 2).

Note: metallic wire (asterix) identifying surgical scar in the union of the upper quadrant of the left breast.



Is there a breast lesion?

67 year-old. Screening mammogram.

Where is the breast lesion?

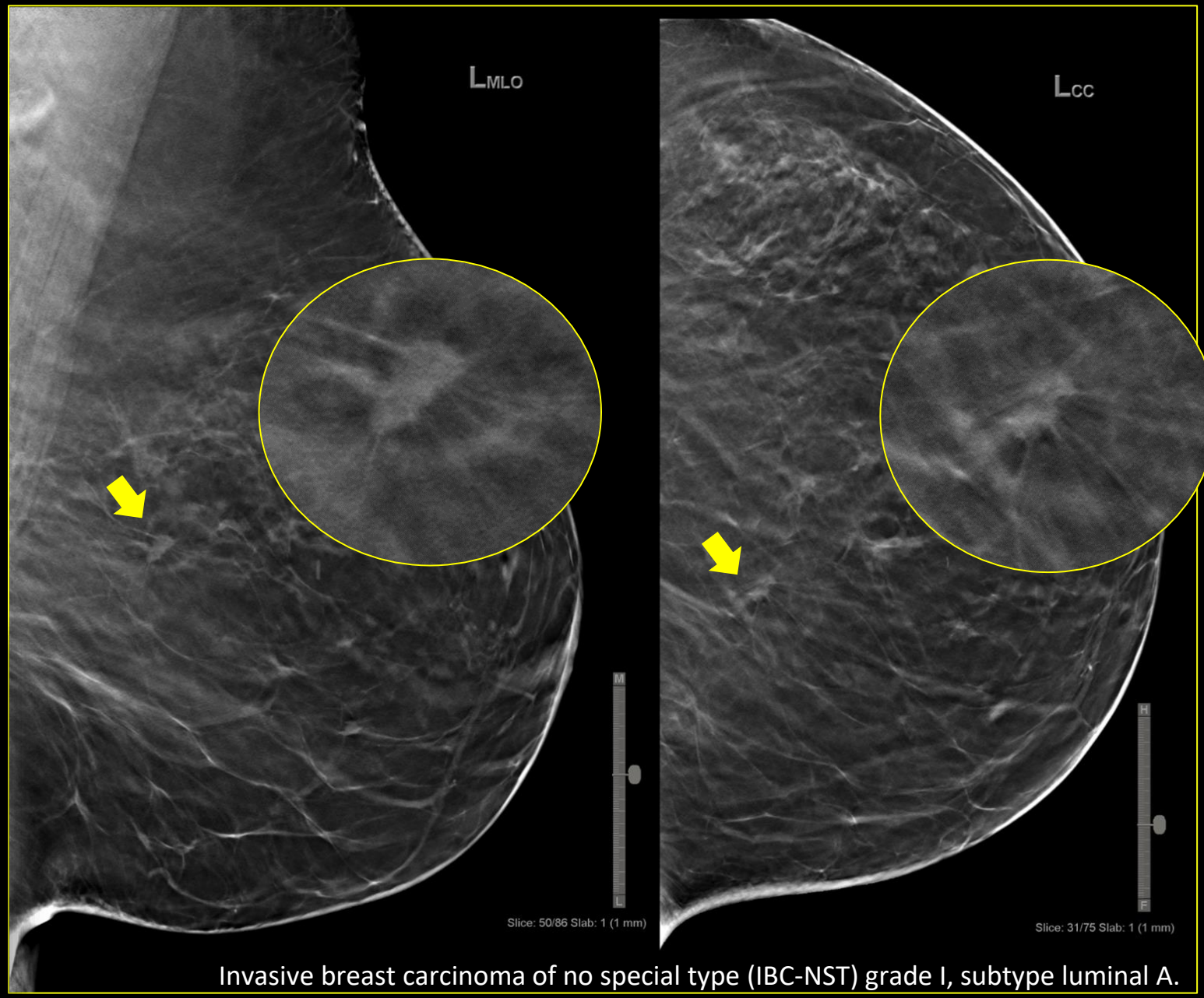
?

Is there a breast lesion?

Teaching point

Tomosynthesis combined with 2D mammography in breast cancer screening can reduce delays in breast cancer diagnosis, improving cancer detection while simultaneously lowering the false positive rate.

DBT reveals a small, dense, oval, **spiculated mass** (arrow) in the posterior third of the left breast, classified as ACR BI-RADS™ 4C. The spiculations are only evident in digital tomosynthesis.



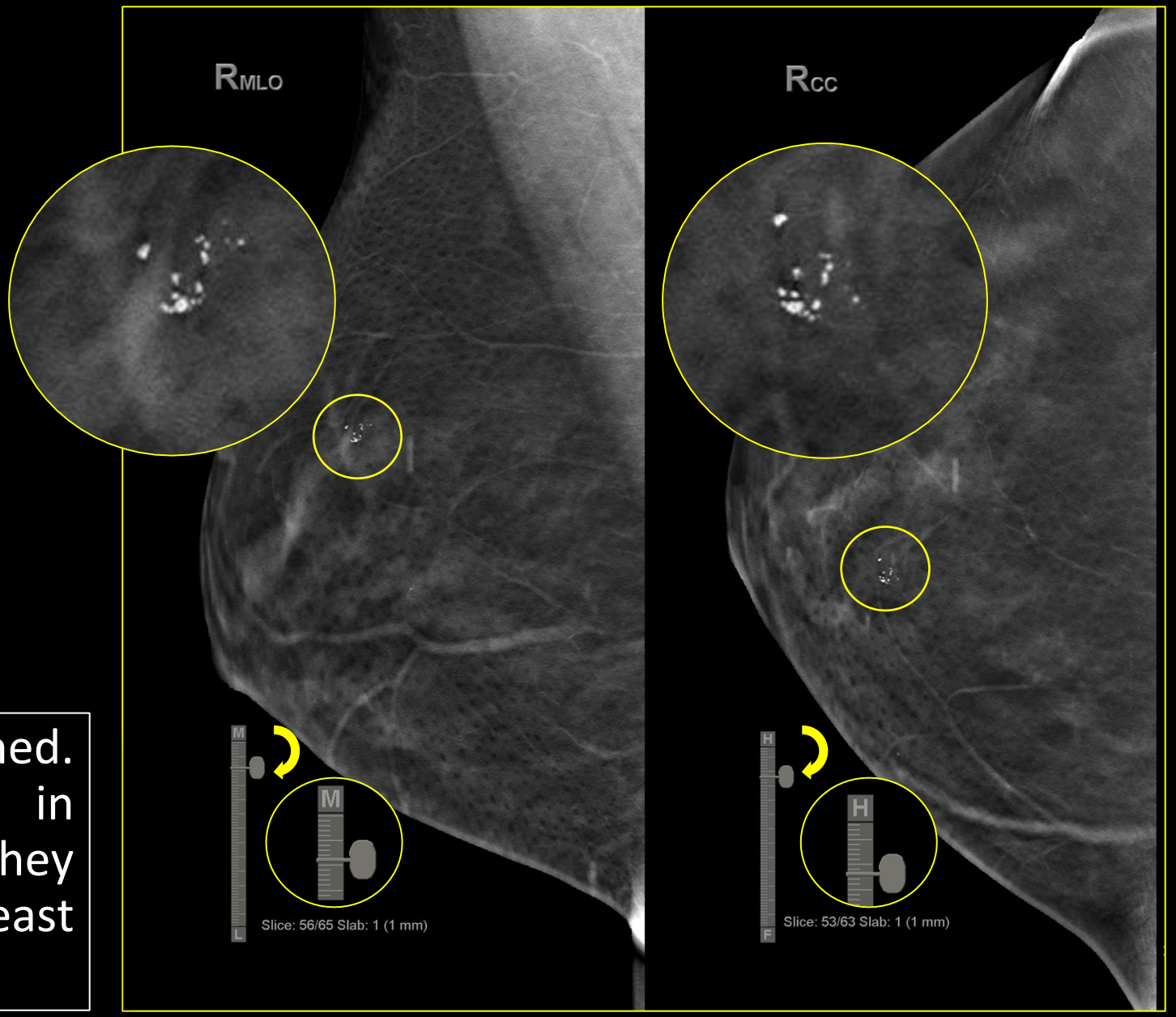
Invasive breast carcinoma of no special type (IBC-NST) grade I, subtype luminal A.

Coarse heterogeneous calcifications?

49 year-old woman. Diagnostic mammography for reevaluation referred as suspicious by another institution.

In 2D mammography, **amorphous and grouped calcifications** (circle) were observed in the mid-third region of the junction of the upper quadrants of the right breast, previously categorized as ACR BI-RADS™ 4 by another institution.

Coarse heterogeneous calcifications?



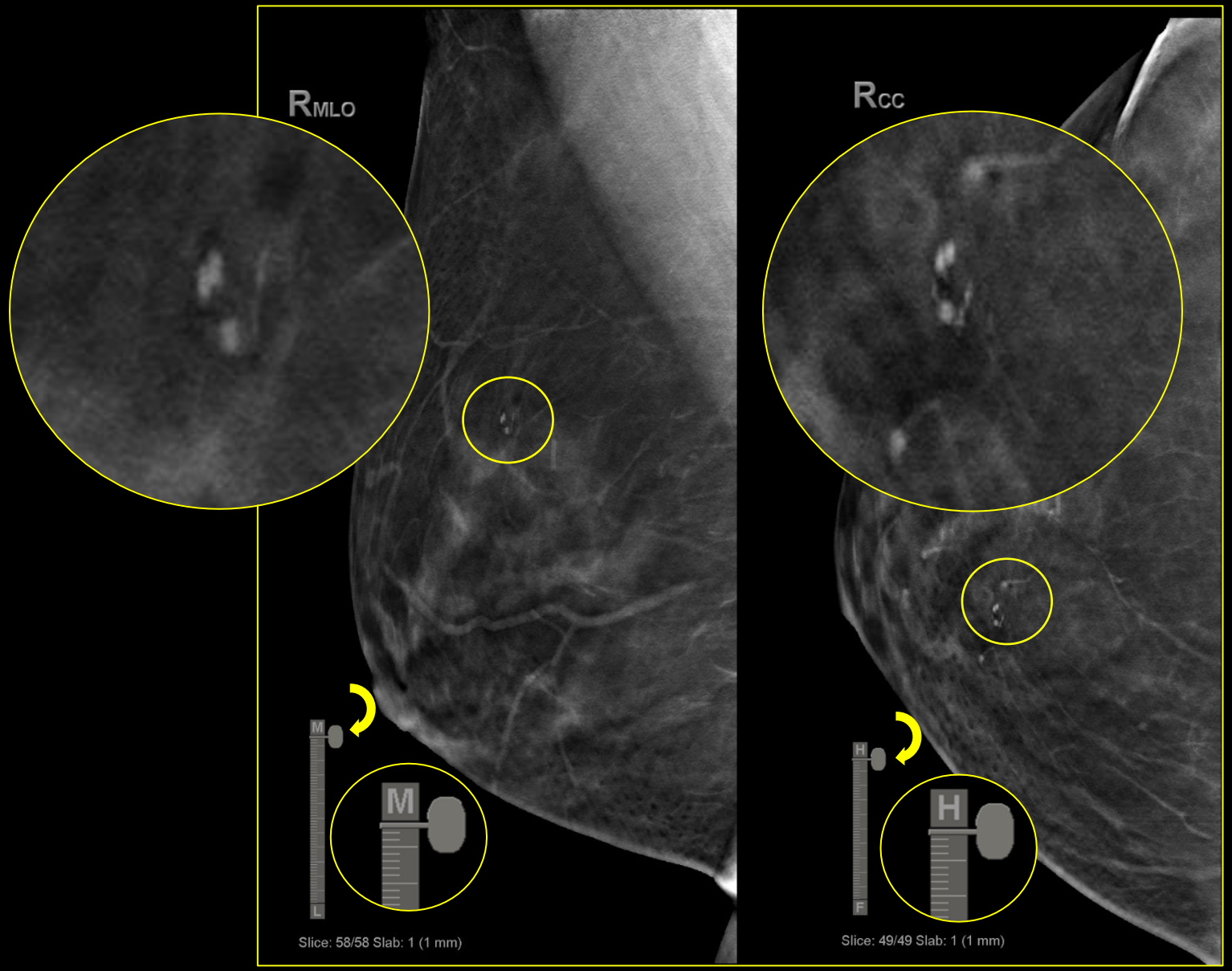
The patient was not properly positioned. Consequently, calcifications appear in the tomosynthesis slice 9, as if they were located in the middle of the breast parenchyma.

Coarse heterogeneous calcifications?

Teaching point

Take care when using the scroll bar. If the nipple axis (superior/inferior or medial/lateral) is not centered, the slice may not align with the nipple, and the lesion's location may be more dependent on positioning.

Although the patient moved during DBT, we were able to detect the presence of **cutaneous calcifications** (circled) in the initial tomosynthesis slice, classified as ACR BI-RADS™ 2, making an unnecessary biopsy procedure avoidable.

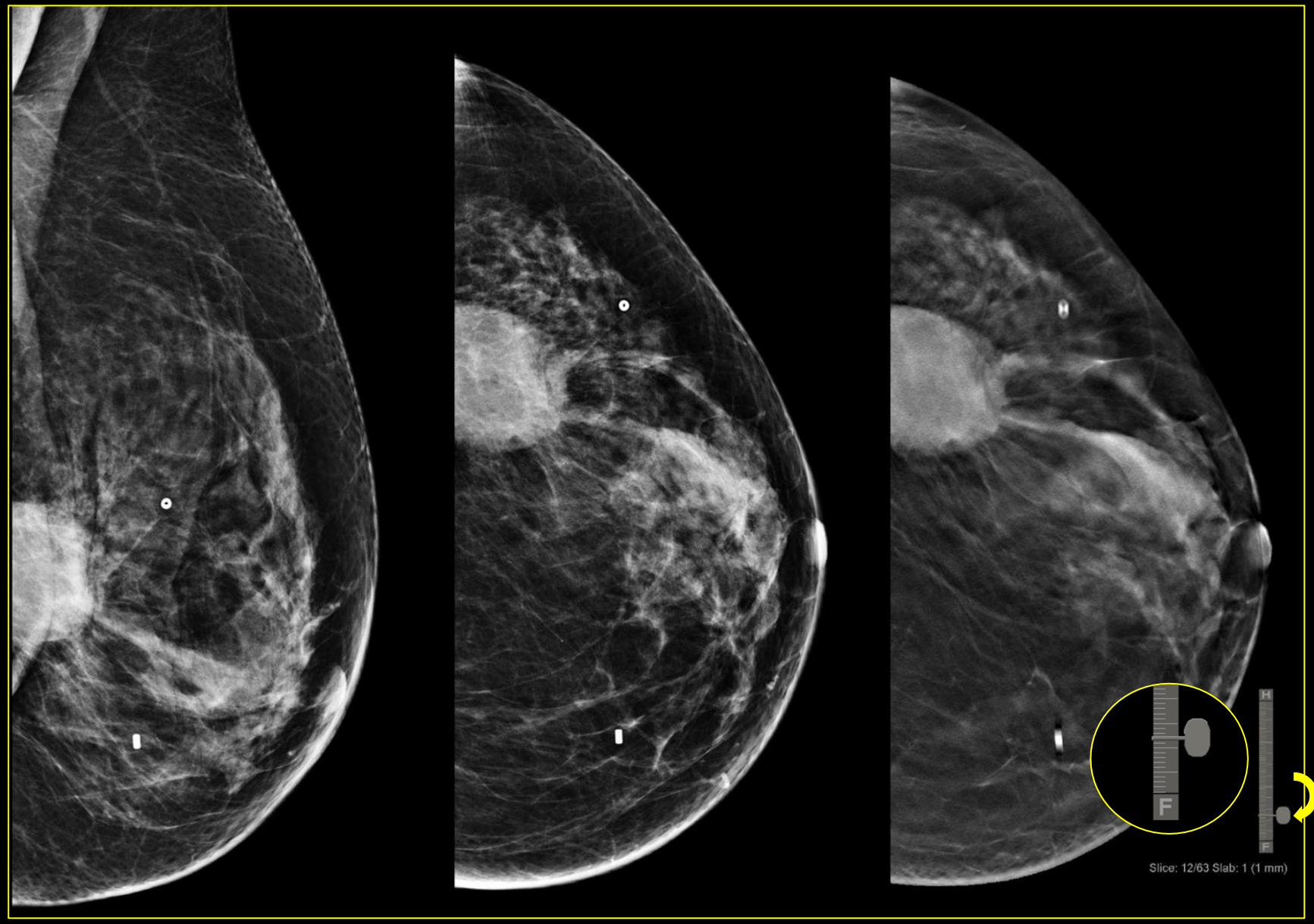


Where´s this mass?

Teaching point

With tomosynthesis, a single slice can yield a 3D location without the need for triangulation using rolling or 90-degree views.

65-year-old woman.
Diagnostic mammogram show a palpable mass.
The **location** of this mass can be identified on the scroll bar, indicating that the lesion is lower as it is closer to the letter 'F' (Foot).

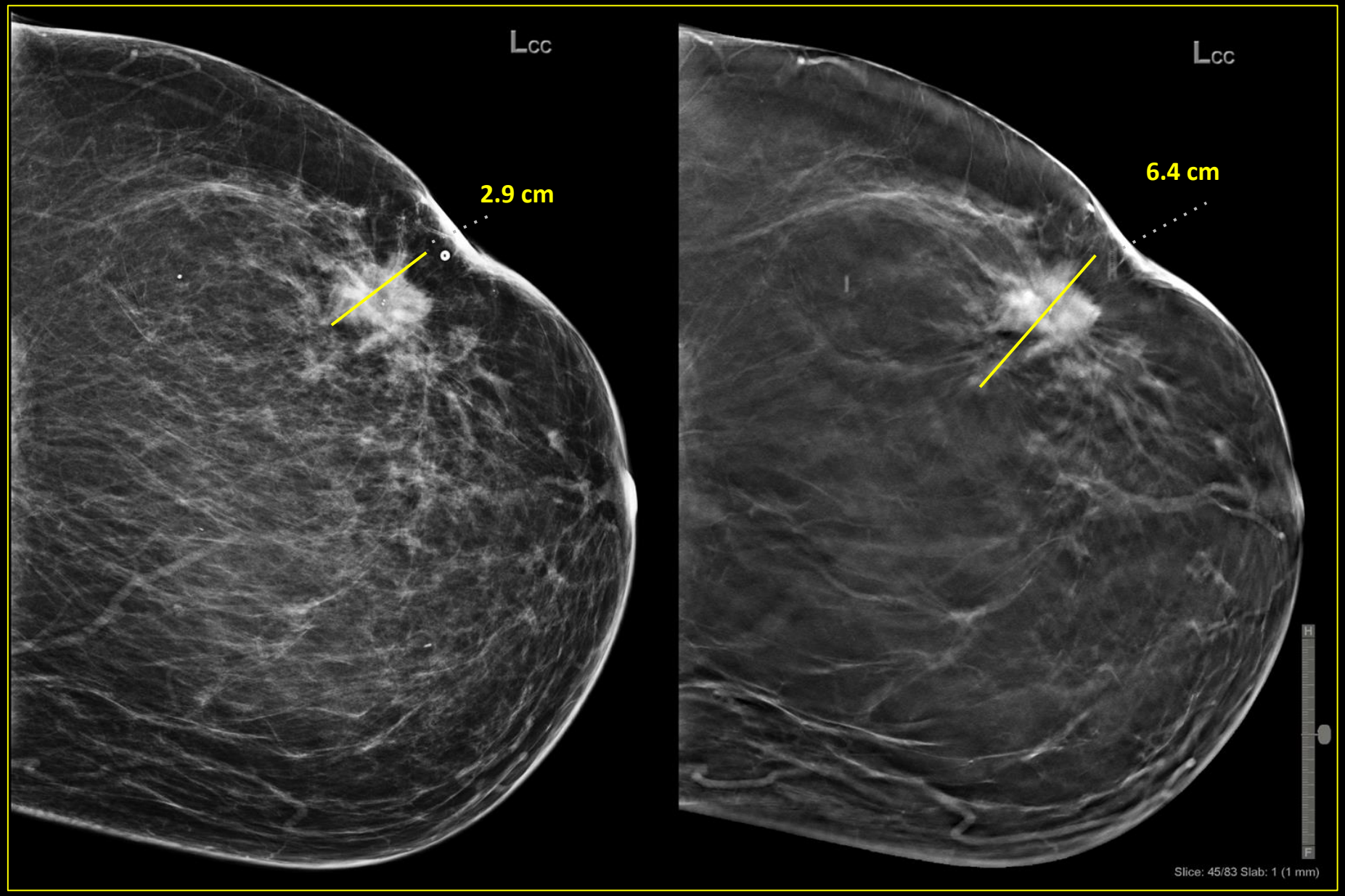


What is the size of this lesion?

Teaching point

DBT enhances disease extent detection and is adequate for diagnostic workup.

65-year-old woman undergoing diagnostic mammography.
The palpable spiculated mass in the left breast measured 2.9 cm on 2D mammography and 6.4 cm on DBT (craniocaudal view) due to the **increase of conspicuity**.



INSTITUTO NACIONAL DE CÂNCER

RSNA 2023
LEADING THROUGH CHANGE

THANK YOU

RSNA
Radiological Society
of North America

820 Jorie Blvd
Oak Brook, IL 60523
TEL 1-630-571-2670
FAX 1-630-571-7837
RSNA.org

19 Feb 2024

To Whom It May Concern:

The presentation below was presented at the RSNA 2023 - 109th Scientific Assembly and Annual Meeting, November 26 to November 30, 2023.

Public ID: BREE-56

Title: Uncovering False Positive Lesions Through DBT

Author List: Giovana D'Avila MD, Giovana D'Avila MD, Rafaela Morais, Carolina Fernandes Ramalho MD, Carolina Fernandes Ramalho MD, Erica Endo MD, Marcele Cortes MD, Thais Salgado Monnerat, Camila Figueiredo MMed, Ana Costa MD, Paula Gomes MD

Presenter: Giovana D'Avila MD,Carolina Fernandes Ramalho MD

For additional information or to view the annual meeting program online, please visit www.rsna.org. Final updates resulting from changes occurring during the Annual Meeting will be available by mid December.

Please contact the RSNA Program Services Department at (877) 776-2227 within the US, or 630-590-7774 outside of the US, or email programs@rsna.org for further assistance.

Sincerely,

Matthew A. Mauro

Matthew A. Mauro, MD
2023 RSNA President