

AMSER Case of the Month

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26 yo female with a right breast mass

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Patient Presentation

HPI:

- 26 yo female presenting for weight management follow-up and evaluation of a 2-week-old right breast mass.
- **Pertinent Positives:** Easy bruising recently.
- **Pertinent Negatives:** Denies breast pain, nipple discharge, skin changes, bloody noses, and joint swelling.

Past Medical History: Obesity, myoneural disorder

Medications: Zepbound 5mg subcutaneous once weekly, Mirena IUD (in place)

Family History: Unknown (patient is adopted)

Physical Exam:

Right breast: Inverted nipple, palpable mass, mild erythema. No nipple discharge.

Breast Mass (Right):

Location: 10 o'clock, 9x6 cm in size from areola edge

Characteristics: Non-tender, firm, irregular, well-defined, fixed

Left breast: normal

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant: 6 Adult female, younger than 30 years of age. Palpable breast mass. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US breast	Usually Appropriate	0
Digital breast tomosynthesis diagnostic	Usually Not Appropriate	☹☹☹
Digital breast tomosynthesis screening	Usually Not Appropriate	☹☹☹
Mammography diagnostic	Usually Not Appropriate	☹☹☹
Mammography screening	Usually Not Appropriate	☹☹☹
Image-guided core biopsy breast	Usually Not Appropriate	Varies
Image-guided fine needle aspiration breast	Usually Not Appropriate	Varies
MRI breast without and with IV contrast	Usually Not Appropriate	0
MRI breast without IV contrast	Usually Not Appropriate	0
FDG-PET breast dedicated	Usually Not Appropriate	☹☹☹
Sestamibi MBI	Usually Not Appropriate	☹☹☹

US was ordered first to assess the mass on the R breast.

Findings (unlabeled)

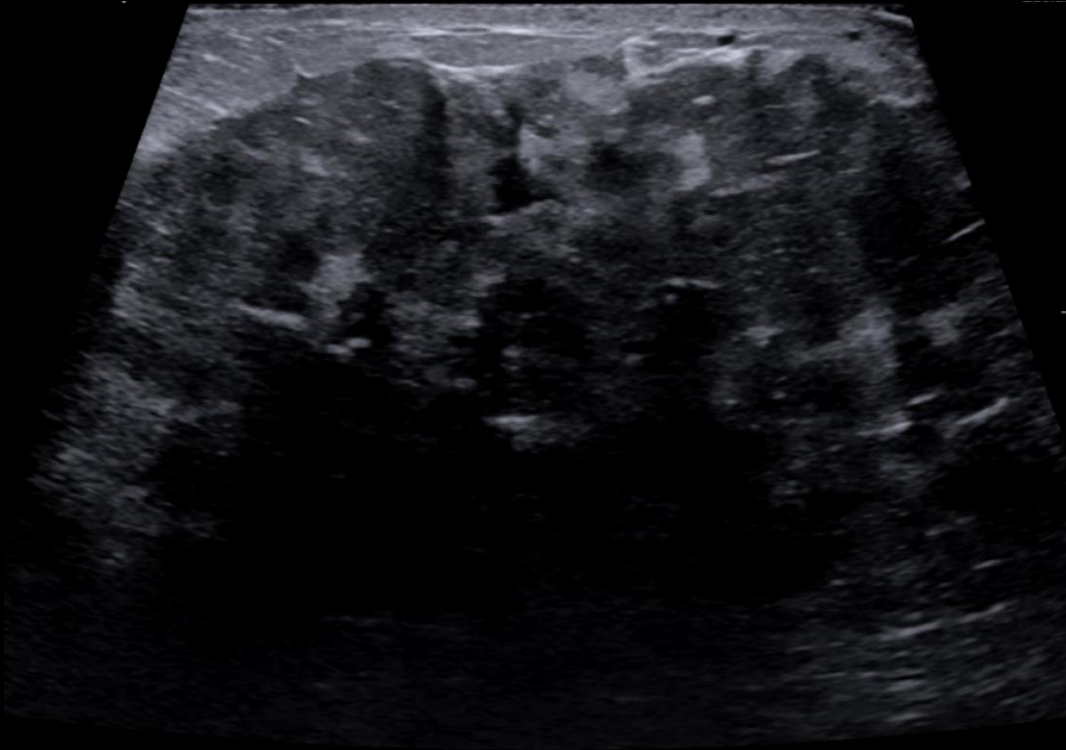


Figure A

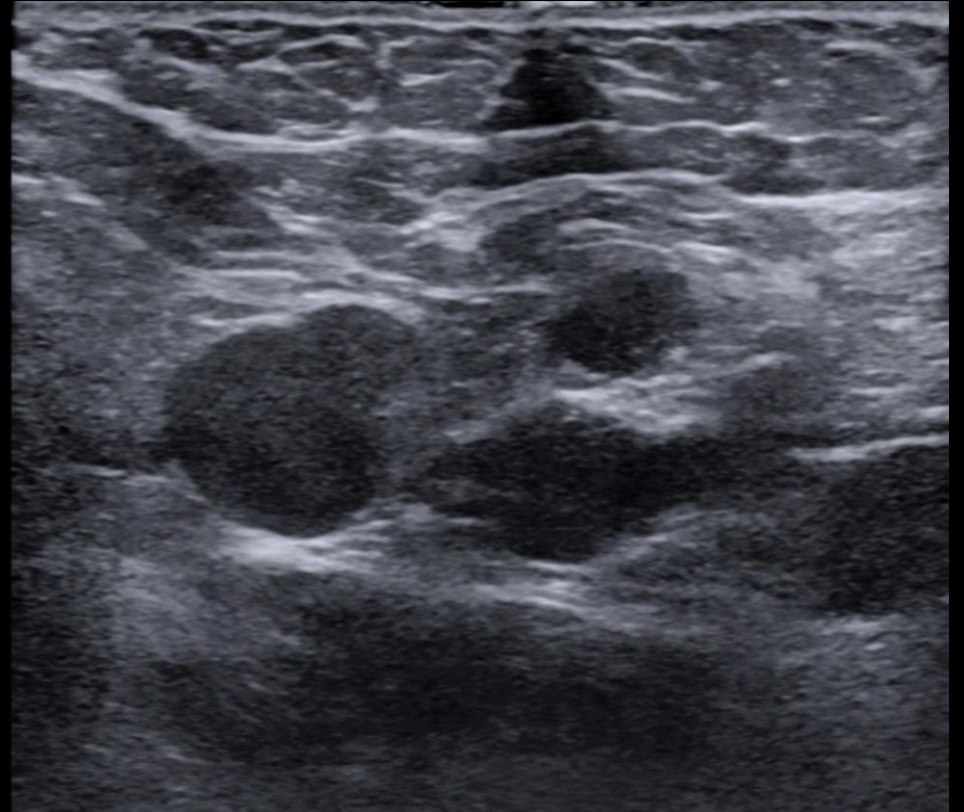


Figure B

Findings (labeled)

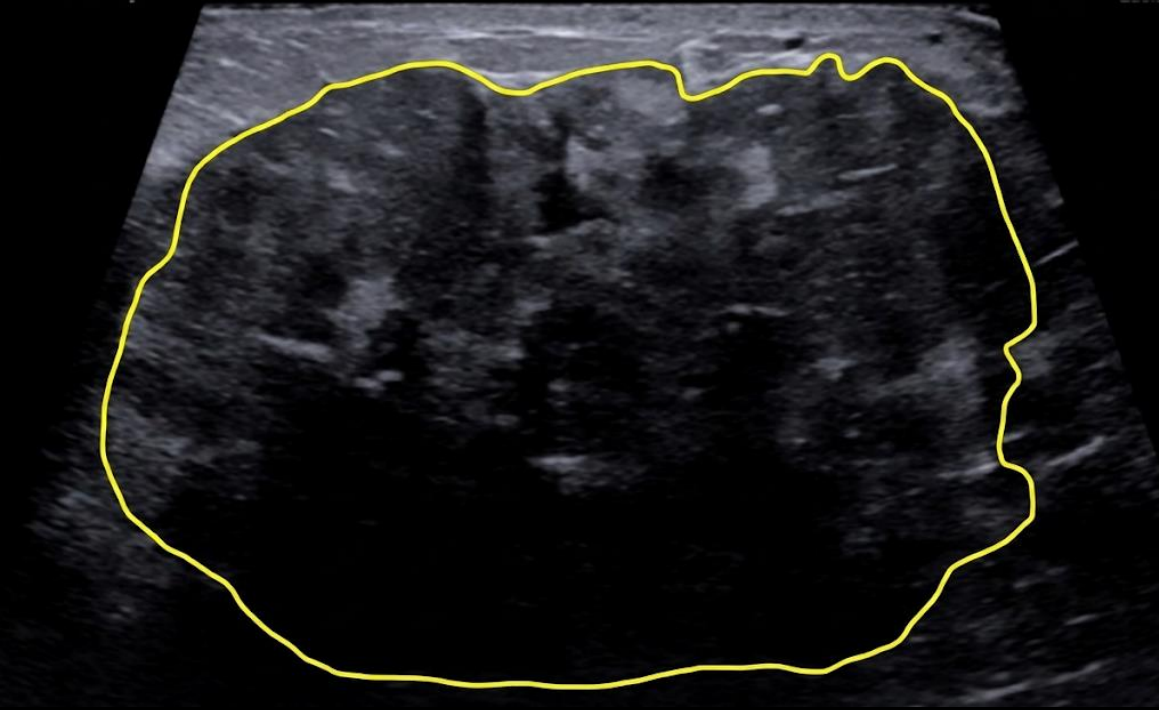


Figure A

Irregular hypoechoic mass with indistinct margins occupying the majority of the R breast, centered at 10 o'clock.

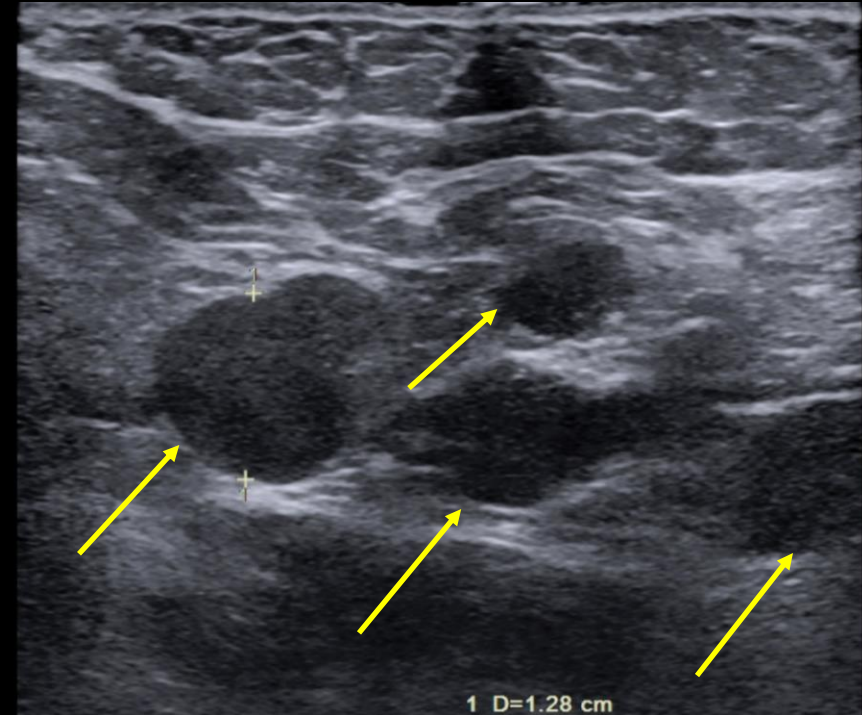


Figure B

Multiple enlarged R axillary lymph nodes with cortical thickening and abnormal morphology.

Select the applicable ACR Appropriateness Criteria

Variant: 7 Adult female, younger than 30 years of age. Palpable breast mass. US findings are suspicious or highly suggestive of malignancy (BI-RADS 4 or 5). Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
Digital breast tomosynthesis diagnostic	Usually Appropriate	☼☼
Mammography diagnostic	Usually Appropriate	☼☼
Image-guided core biopsy breast	Usually Appropriate	Varies
Image-guided fine needle aspiration breast	May Be Appropriate (Disagreement)	Varies
Digital breast tomosynthesis screening	Usually Not Appropriate	☼☼
Mammography screening	Usually Not Appropriate	☼☼
MRI breast without and with IV contrast	Usually Not Appropriate	○
MRI breast without IV contrast	Usually Not Appropriate	○
FDG-PET breast dedicated	Usually Not Appropriate	☼☼☼
Sestamibi MBI	Usually Not Appropriate	☼☼☼

Diagnostic mammogram with digital breast tomosynthesis + a US-guided core biopsy of the breast and axillary lymph node were done for further evaluation of the mass seen on ultrasound.

Findings (unlabeled)

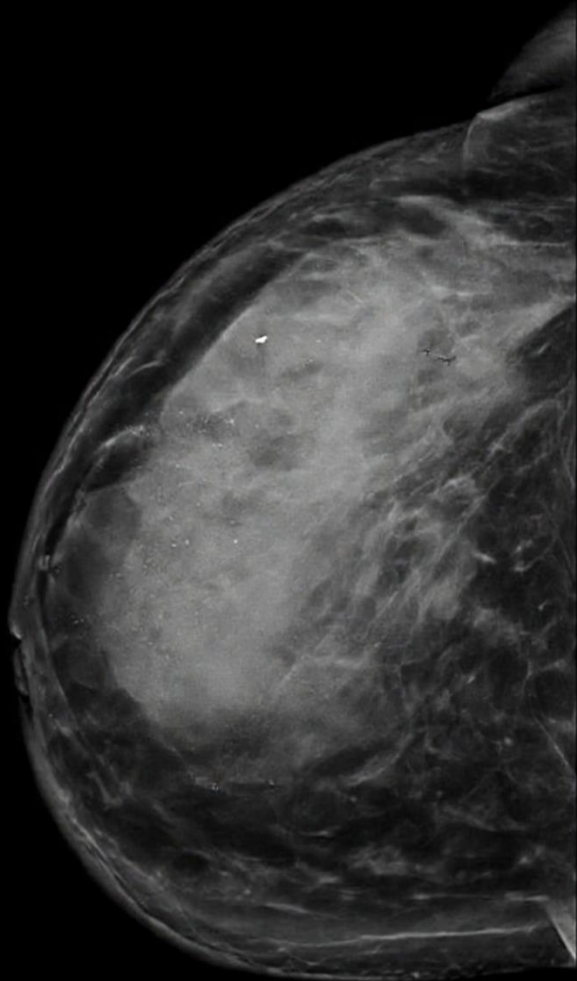


Figure A

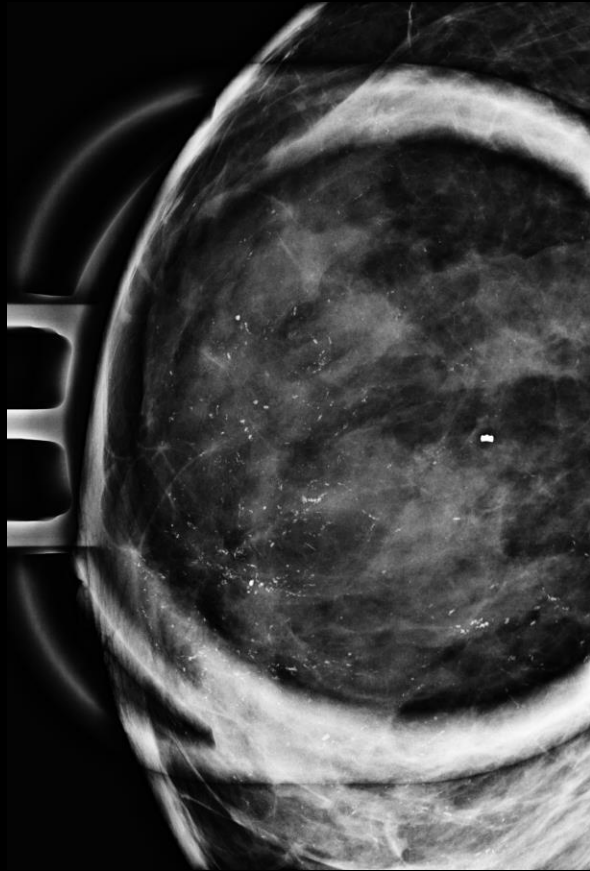


Figure B

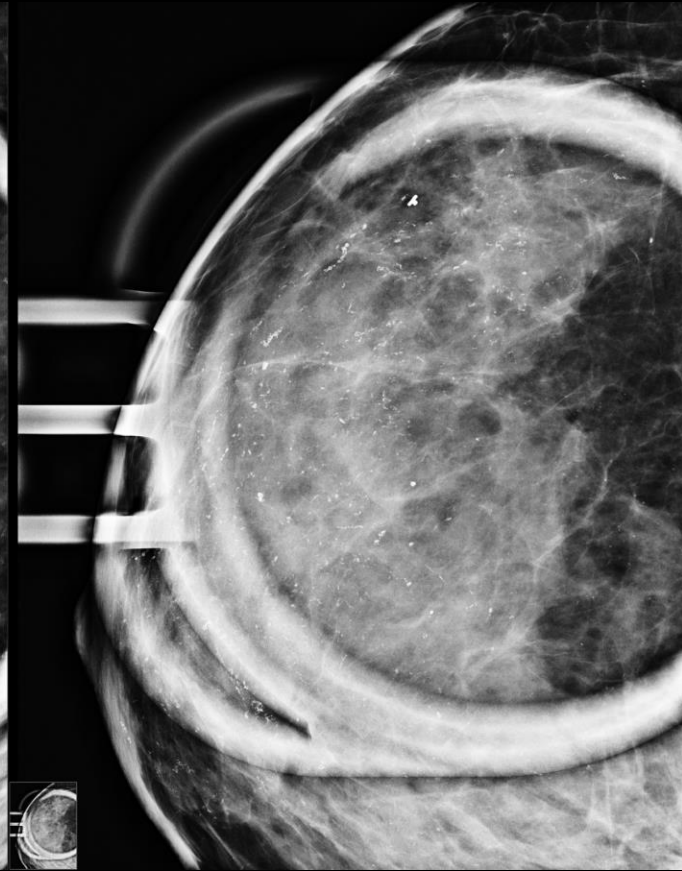


Figure C

Findings (labeled)

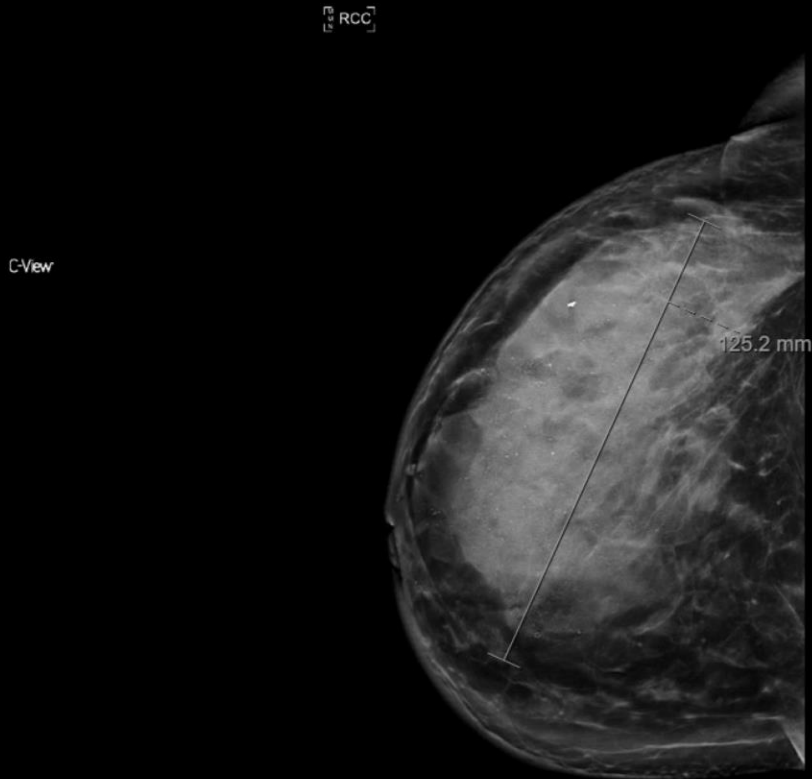


Figure A

Craniocaudal mammogram demonstrating an irregular mass measuring 12.5 x 12.5 cm with indistinct margins and associated calcifications in the lateral R breast.

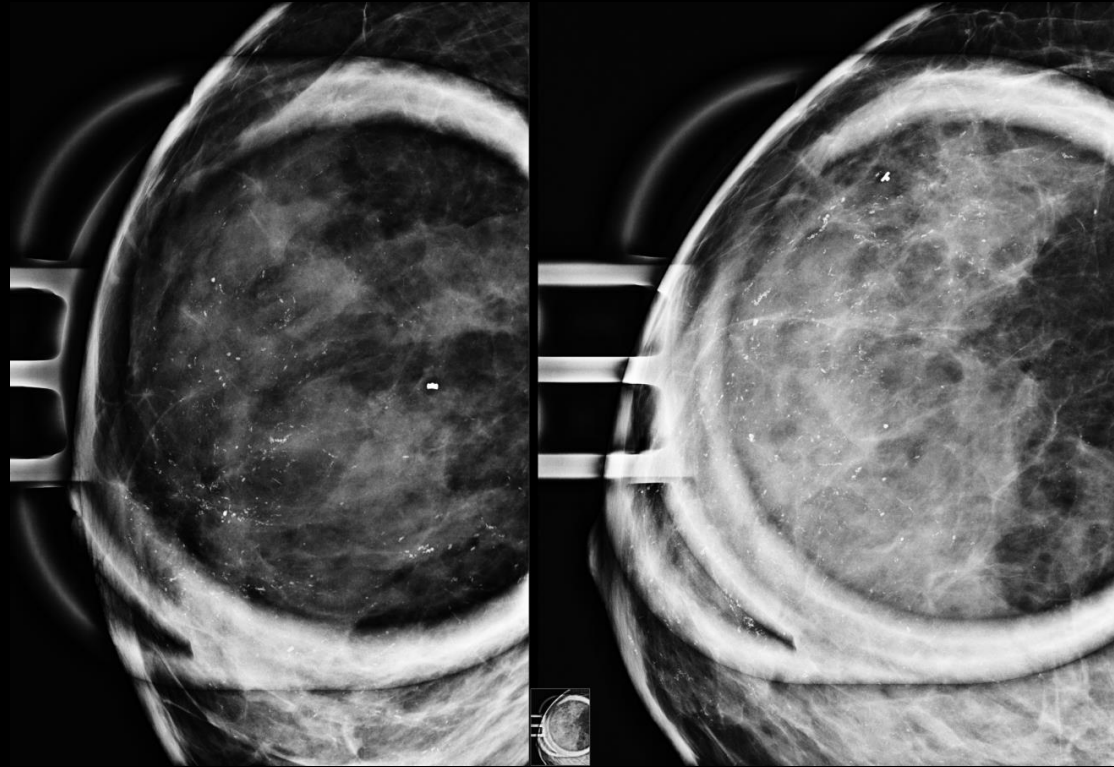


Figure B

Figure C

R craniocaudal (**Figure B**) and R medio-lateral (**Figure C**) magnification views showing fine pleomorphic calcifications measuring 14 cm with diffuse distribution.

Select the applicable ACR Appropriateness Criteria

Variant: 1 Adult female or male or transfeminine (male-to-female) or transmasculine (female-to-male). Known breast cancer. Initial determination of tumor size and extent within the breast prior to neoadjuvant chemotherapy. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US breast	Usually Appropriate	0
Digital breast tomosynthesis diagnostic	Usually Appropriate	☼☼
Mammography diagnostic	Usually Appropriate	☼☼
MRI breast without and with IV contrast	Usually Appropriate	0
MRI breast without IV contrast	Usually Not Appropriate	0
Sestamibi MBI	Usually Not Appropriate	☼☼☼
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☼☼☼☼

MRI breast without and with IV contrast was done to assess tumor size and extent prior to management.

Findings (unlabeled)

Figure A

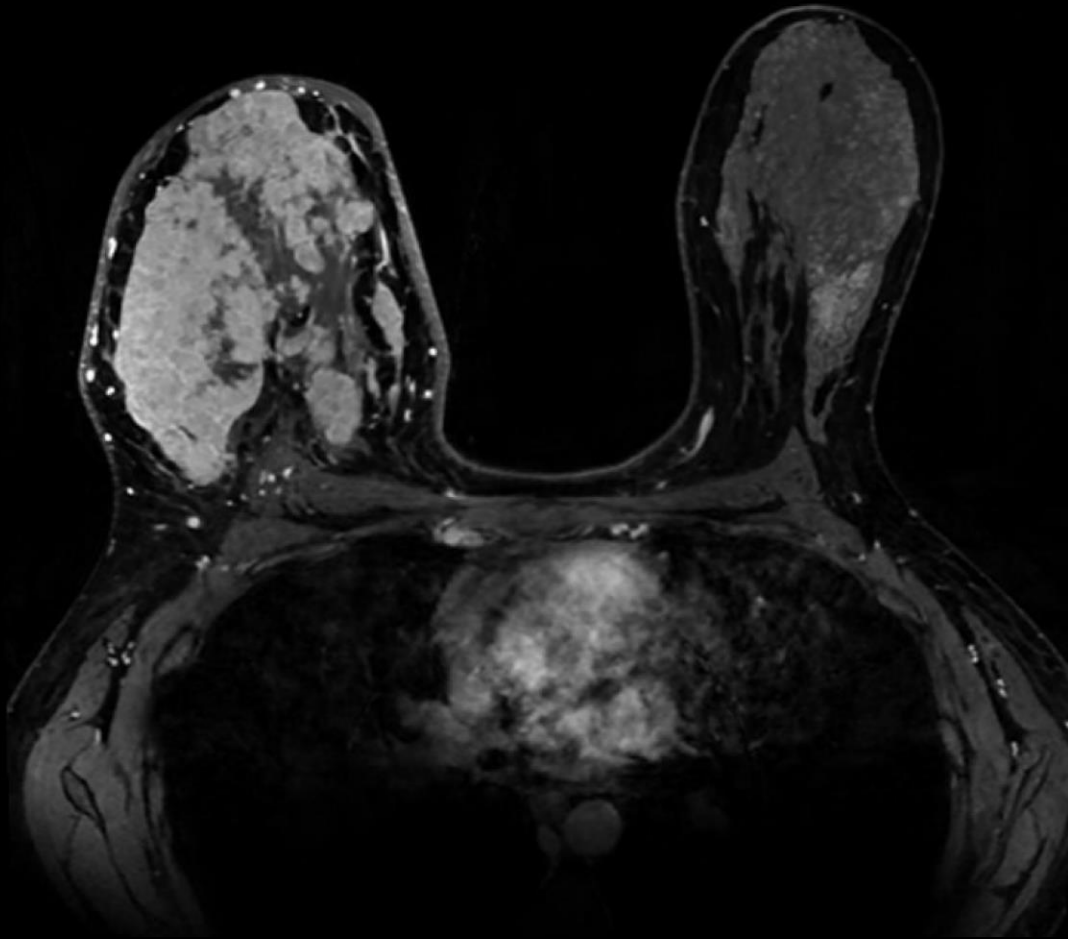


Figure B

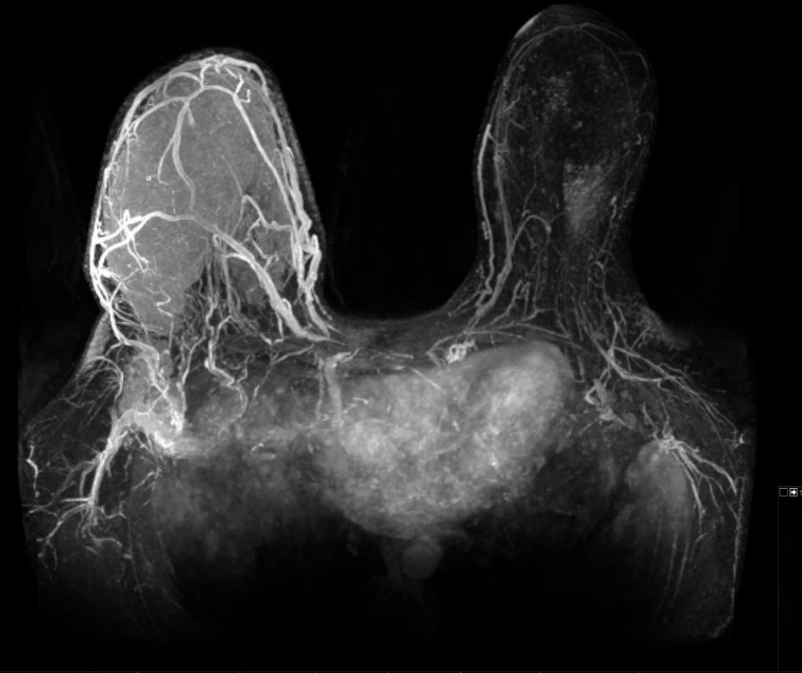
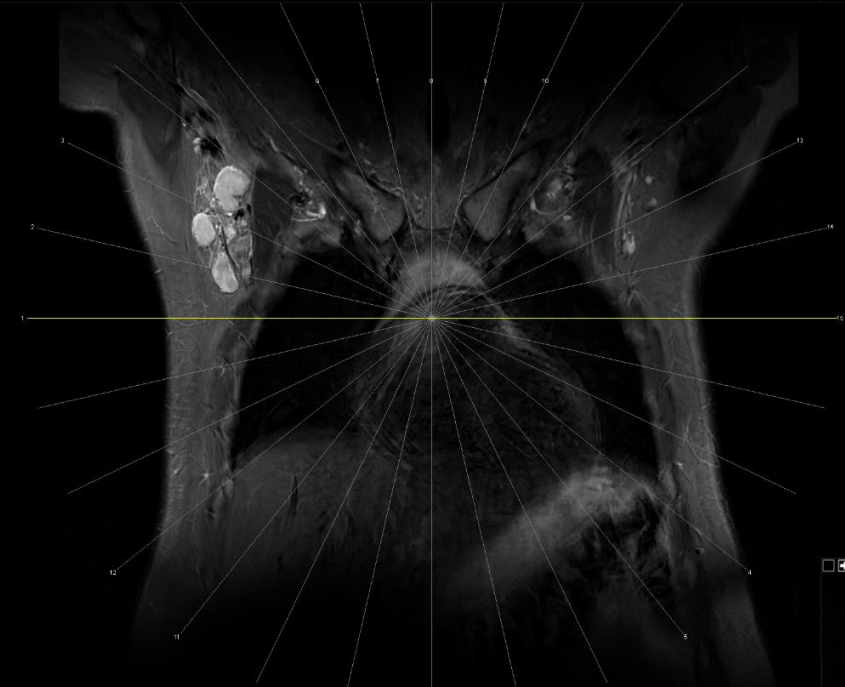


Figure C



Findings (labeled)

Figure A

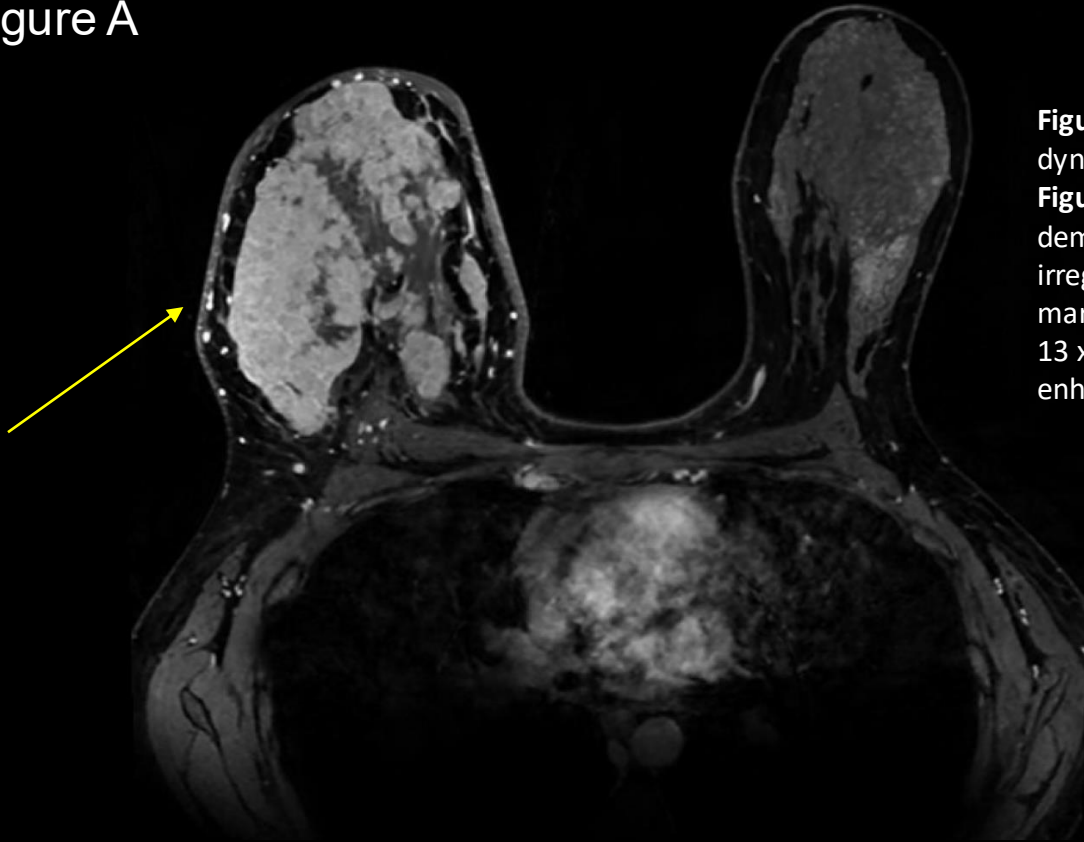


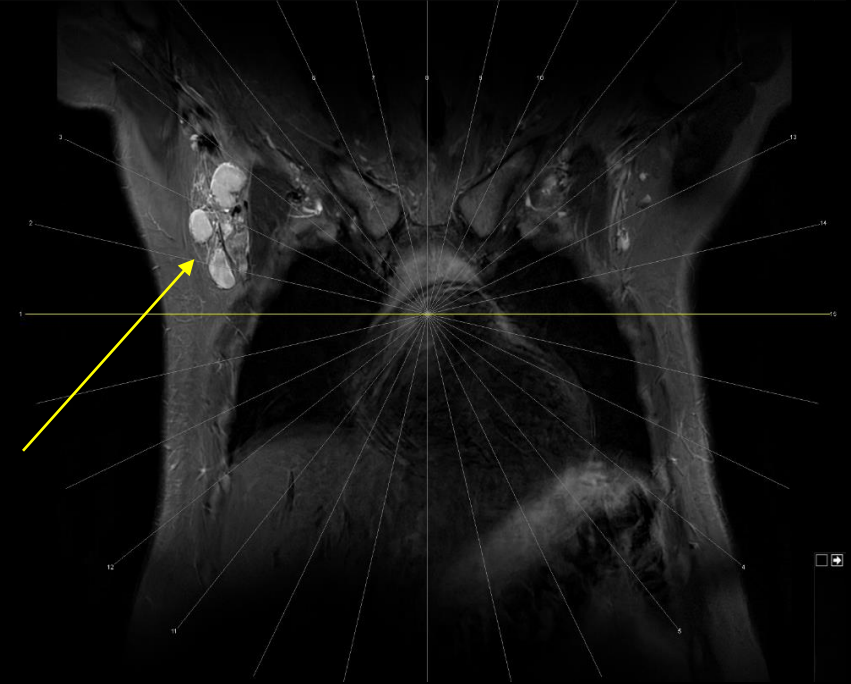
Figure A (Ph2/T1 multiphase, axial dynamic post contrast imaging) and **Figure B** (Axial MIP) both demonstrating a conglomerate of irregular masses with irregular margins inclusively measuring 14 x 13 x 9 cm in the R breast. Internal enhancement is heterogeneous.

Figure B



Figure C

Coronal T2 STIR revealing an enlarged and abnormal morphology of multiple axillary lymph nodes.



Final Dx

**Inflammatory breast cancer of the right breast
(histological subtype of invasive ductal carcinoma)
with regional metastasis to the right axillary lymph
nodes**

16 cm, Grade 3, ER-/PR-/HER2+

Case Discussion: Management of Our Patient

- **Treatment:**

- systemic chemotherapy combined with dual HER2 blockade using Trastuzumab and Pertuzumab, followed by a right total mastectomy and right axillary lymph node dissection.

- **Post-Surgical Pathology Results:**

- **Pathologic Complete Response (pCR):** Achieved pCR for the invasive cancer, with zero residual invasive carcinoma remaining in either the breast or the axilla.
- **Nodal Status:** 0 out of 10 recovered lymph nodes (which were initially cancerous) were positive for metastasis.
- **Residual Non-Invasive Disease:** A tiny, 2.5 mm residual focus of high-grade, ER-/PR- non-invasive Ductal Carcinoma In Situ (DCIS) was identified.
- **Surgical Margins:** Widely clear margins were achieved for both the invasive tumor and the DCIS.
- **Final Post-Treatment Stage:** ypTis N0, indicating an exceptional, near-total therapeutic response to the systemic targeted agents.

Inflammatory Breast Cancer

- A rare, highly aggressive disease characterized by the rapid onset of breast erythema, global skin edema, and a classic “peau d'orange” appearance.^{5,6}
- Unlike typical presentations, IBC frequently lacks a discrete, localized tumor mass; instead, it's classified by its diffuse, rapid obstruction of the dermal lymphatics by tumor emboli.⁶
- A formal diagnosis requires pathological confirmation of invasive malignancy, with invasive ductal carcinoma serving as the predominant underlying histological subtype.⁵

Invasive Ductal Carcinoma

- Invasive ductal carcinoma is the most common presentation of invasive disease; frequently manifests with high nuclear grade kinetics and rapid regional lymphovascular invasion in young cohorts.^{1,3}
- **HER2+/ER-/PR- Subtype:** Accounts for 15% to 20% of all breast cancers; historically associated with high recurrence risks and poor overall prognosis prior to targeted therapeutics.³
- **Etiology:**
 - Driven by the amplification of the *HER2/neu* (ErbB2) gene on chromosome 17q. This leads to transmembrane receptor tyrosine kinase overexpression, which triggers continuous downstream cellular proliferation.³
 - Approximately 90% of early-onset breast cancers (patients under age 40) occur in noncarriers of the *BRCA* mutation. Younger women are disproportionately affected by aggressive, high-grade HER2-enriched and triple-negative phenotypes.¹

- **Clinical Presentation:** Because young women fall outside routine screening populations, presentation is almost always symptomatic, classically presenting as a palpable breast mass or palpable axillary lymphadenopathy.¹
- **Classic Imaging Findings**
 - **Ultrasound:** classically shows an irregular, hypoechoic, "taller-than-wide" mass.^{2,3}
 - **Mammography / DBT:** typically reveals an irregular, high-density, spiculated mass with fine pleomorphic microcalcifications (~60% of HER2+ cases).^{2,3}
 - **MRI:** typically presenting as a mass or as non-mass enhancement (NME); findings remain the best predictor of pathologic response to neoadjuvant therapy.³
 - **Axillary Sonography:** Critical for regional staging; metastatic nodes display cortical thickening ≥ 3 mm, eccentric lobulation, or complete loss of the fatty hilum.⁴

- **Treatment**

- Early-stage HER2-positive and node-positive diseases are treated with pre-surgery systemic chemotherapy and dual HER2-targeted antibodies (e.g., trastuzumab and pertuzumab).^{3,4}
- Effective pre-surgery therapy shrinks tumors and clears lymph nodes, allowing safe de-escalation from radical mastectomy to breast-conserving lumpectomy and sentinel lymph node biopsy.^{3,4}
- Tumor response to initial therapy guides post-operative targeted treatments. Breast MRIs act as the best *in vivo* predictor of final pathologic response.³

- **Prognosis**

- Modern anti-HER2 targeted therapies have drastically improved overall survival rates for this aggressive cancer type.³
- Achieving a complete eradication of invasive tumor cells in the breast and lymph nodes by surgery is a critical surrogate marker for excellent long-term survival.³
- Being under 40 is a historical risk factor for poor prognosis due to aggressive subtypes, but standard guideline-based targeted regimens significantly improve survival outcomes for these patients.^{1,3}

References

1. Gao Y, Samreen N, Heller SL. Non-BRCA early-onset breast cancer in young women. *RadioGraphics*. 2022;42(1):5-22. <https://doi.org/10.1148/rg.210109>
2. Klein KA, Kocher M, Lourenco AP, et al. ACR Appropriateness Criteria® palpable breast masses: 2022 update. *J Am Coll Radiol*. 2023;20(5):S146-S163. <https://doi.org/10.1016/j.jacr.2023.02.013>
3. Portnow LH, Kochkodan-Self JM, Maduram A, et al. Multimodality imaging review of HER2-positive breast cancer and response to neoadjuvant chemotherapy. *RadioGraphics*. 2023;43(5):e20103. <https://doi.org/10.1148/rg.220103>
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6. Le-Petross HT, Balema W, Woodward WA. Why diagnosing inflammatory breast cancer is hard and how to overcome the challenges: a narrative review. *Chin Clin Oncol*. 2021;10(6):58. <https://doi.org/10.21037/cco-21-116>