BI-RADS Terminology

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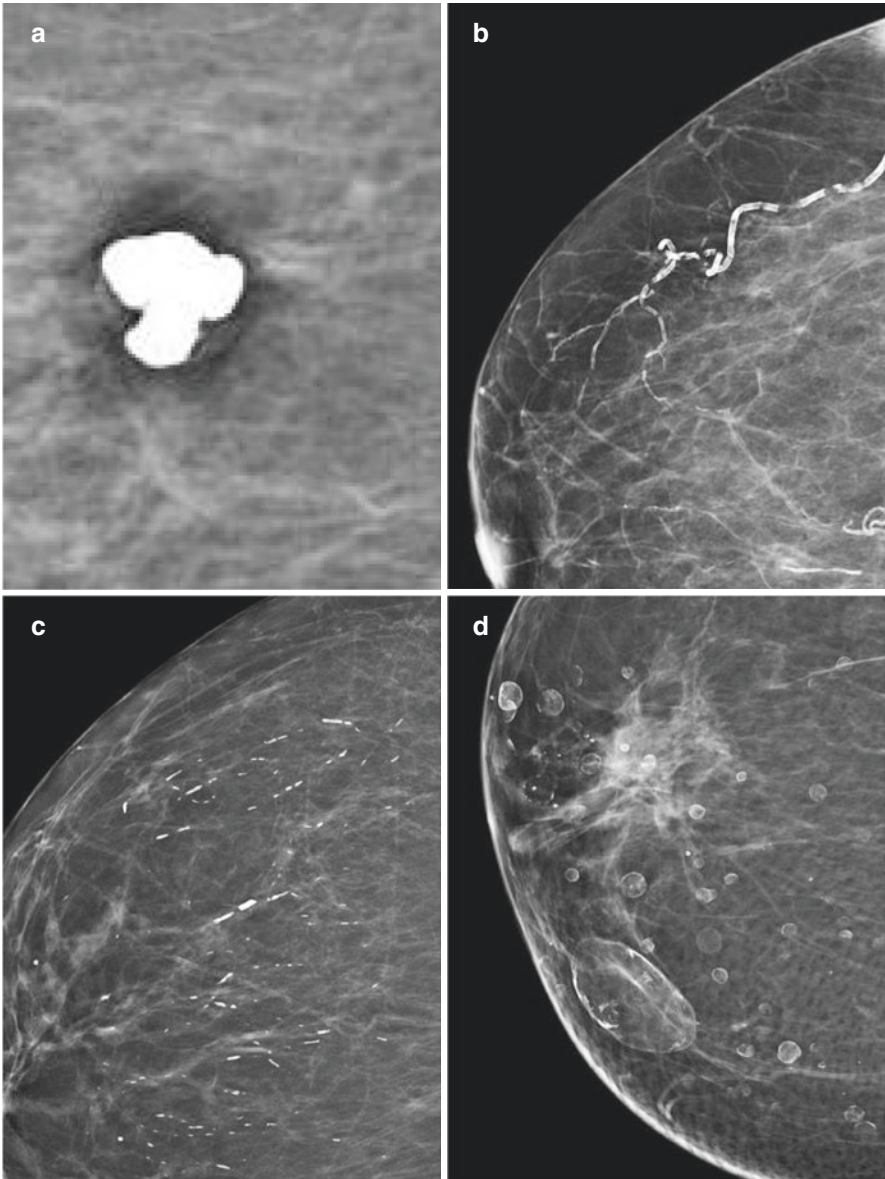
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1. Match the following images with the following calcification morphology: vascular, popcorn, rim, rod-like.

(a) A—rim; B—rod-like; C—vascular; D—popcorn.
(b) A—vascular; B—rim; C—rod-like; D—popcorn.
(c) A—popcorn; B—rod-like; C—vascular; D—rim.
(d) A—popcorn; B—vascular; C—rod-like; D—rim.

2. Match the following images with the following calcification morphology: suture, coarse heterogeneous, round, dystrophic, amorphous.
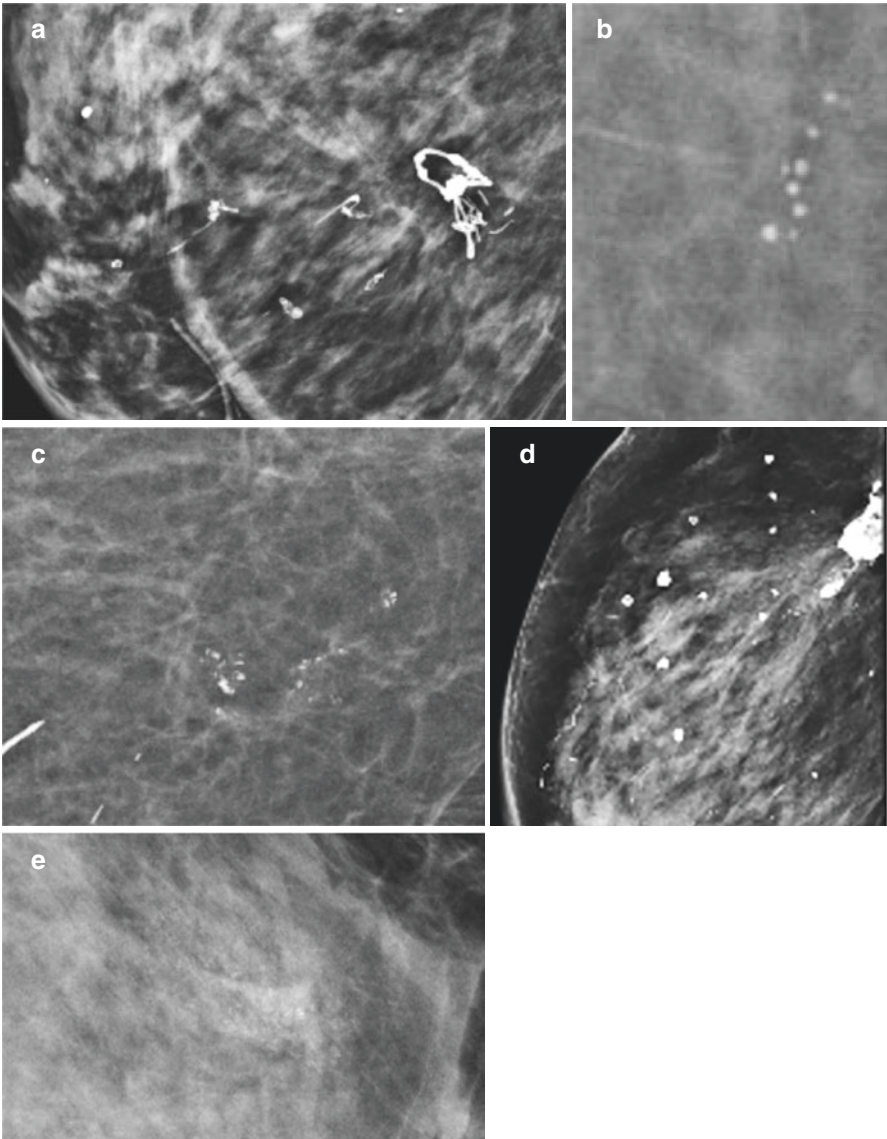
(a) A—amorphous; B—dystrophic; C—round; D—coarse heterogeneous; E—suture.
(b) A—round; B—amorphous; C—dystrophic; D—suture; E—coarse heterogeneous.

(c) A—coarse heterogeneous; B—dystrophic; C—amorphous; D—suture; E—round.

(d) A—suture; B—round; C—coarse heterogeneous; D—dystrophic; E—amorphous.

3. Match the following images with the following calcification distribution patterns: grouped, regional, segmental, diffuse, linear.
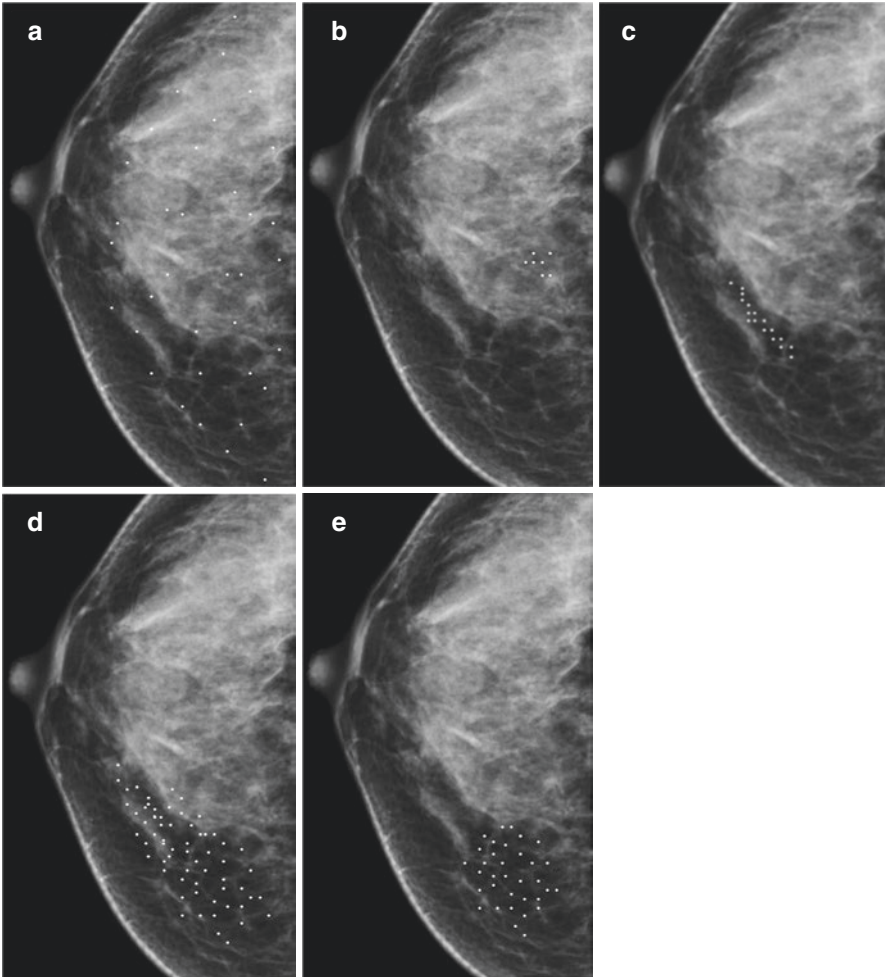

(a) A—diffuse; B—linear; C—grouped; D—regional; E—segmental.
(b) A—diffuse; B—grouped; C—linear; D—segmental; E—regional.
(c) A—regional; B—segmental; C—linear; D—diffuse; E—grouped.
(d) A—regional; B—grouped; C—segmental; D—linear; E—diffuse.

4. A patient presents for a diagnostic mammogram for a finding seen on a screening mammogram, shown below. It is present on CC and MLO view. How should this finding be described according to the BI-RADS lexicon?
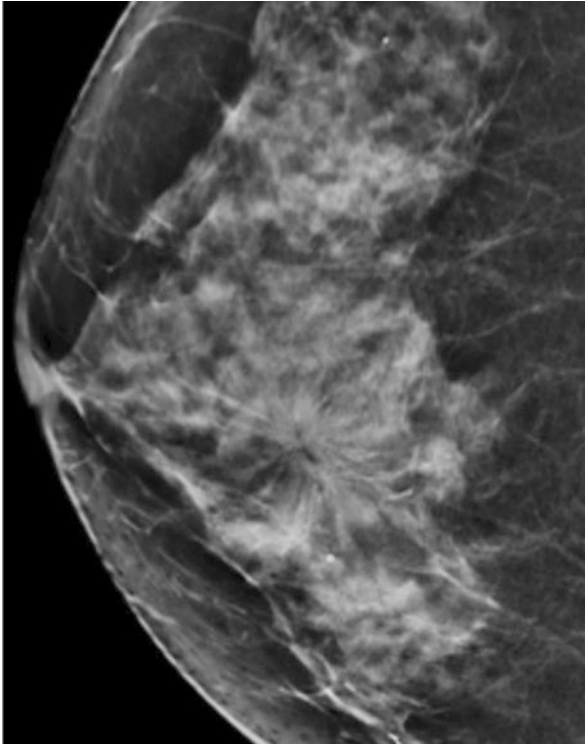
   (a) Asymmetry.
   (b) Architectural distortion.
   (c) Focal density.
   (d) Geographic abnormality.

5. A patient underwent diagnostic evaluation for a mass seen on screening mammography. On diagnostic evaluation, the mass was assigned a BI-RADS category 4B. What is the likelihood of malignancy corresponding to BI-RADS category 4B?
   (a) >2% to ≤10%.
   (b) >25% to <75%.
   (c) >10% to ≤50%.
   (d) >50% to <95%.

6. Identify the following mass shapes:
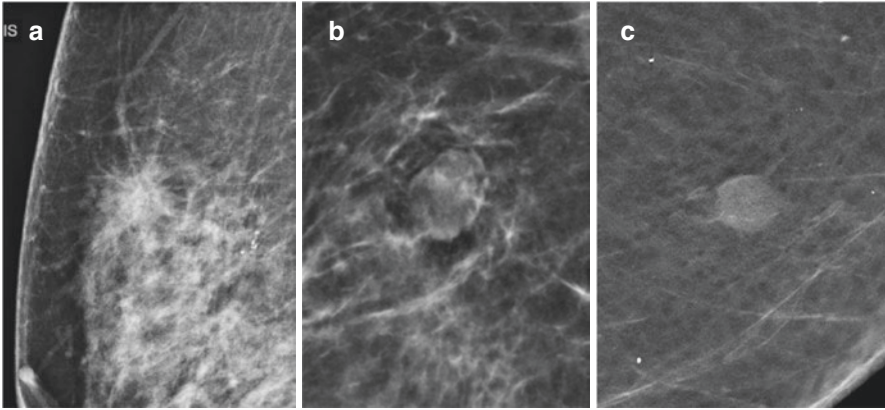
(a) A—irregular; B—oval; C—round.
(b) A—round; B—ovoid; C—oval.
(c) A—irregular; B—ovoid; C—round.
(d) A—irregular; B—round; C—ovoid.

7. Match the following images with the following margin types: circumscribed, obscured, microlobulated, and indistinct.
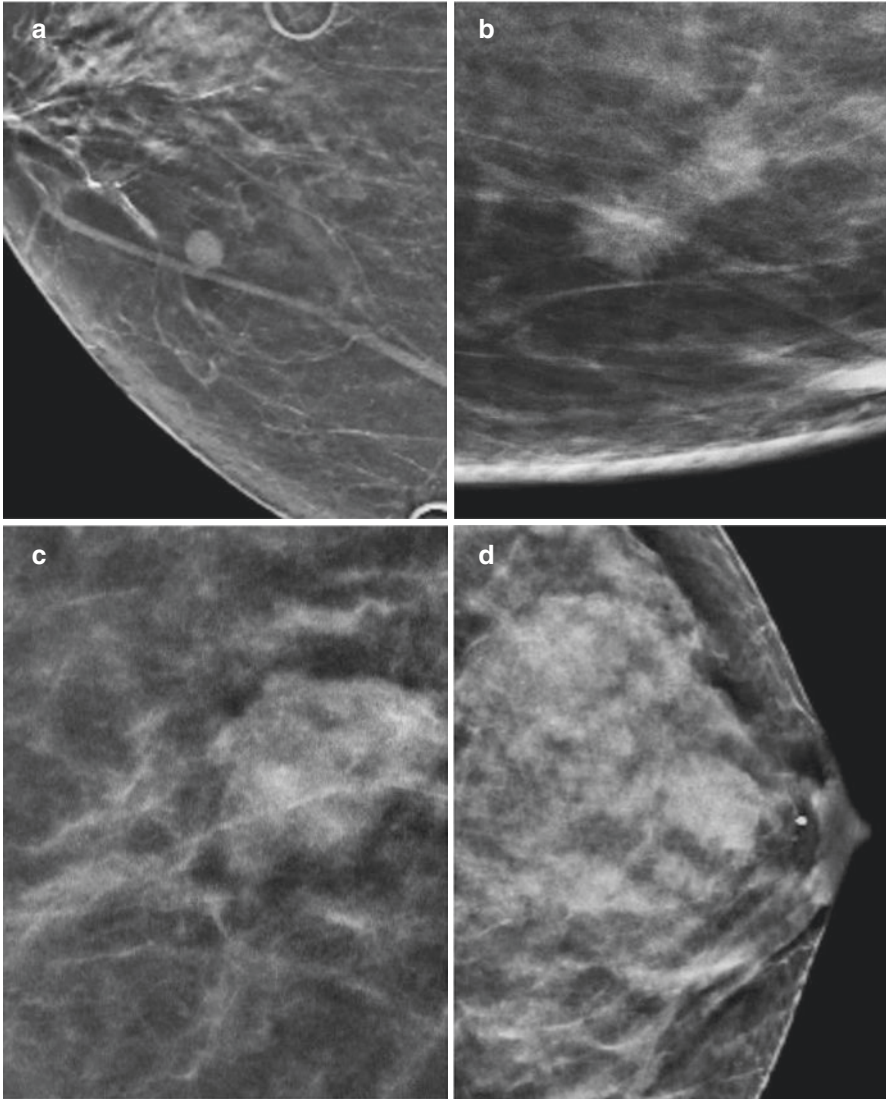
(a) A—circumscribed; B—obscured; C—indistinct; D—microlobulated.
(b) A—circumscribed; B—indistinct; C—microlobulated; D—obscured.
(c) A—circumscribed; B—indistinct; C—obscured; D—microlobulated.
(d) A—circumscribed; B—microlobulated; C—indistinct; D—obscured.

8. A patient underwent diagnostic evaluation for a palpable mass, shown below. What is the echogenicity of the mass?
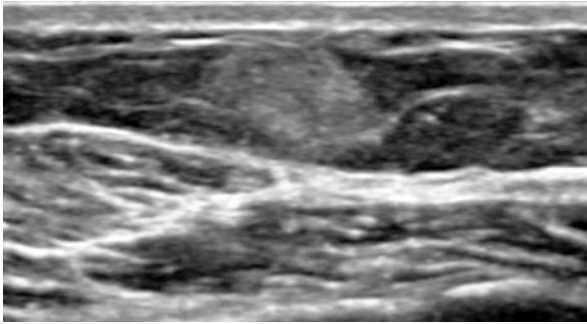
    (a) Hypoechoic.
    (b) Hyperechoic.
    (c) Isoechoic.
    (d) Mixed hypoechoic/hyperechoic.

9. What are the margins of the finding seen on the ultrasound image below?
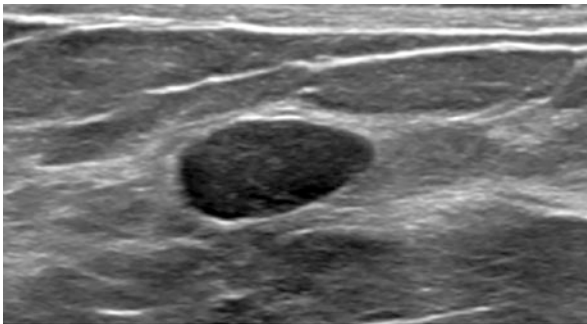
    (a) Circumscribed.
    (b) Indistinct.
    (c) Parallel.
    (d) Spiculated.

10. What are the margins of the mass seen on the ultrasound image below?
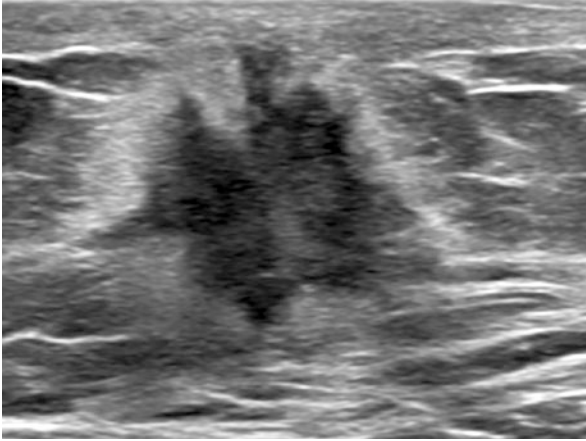
(a) Circumscribed.
(b) Indistinct.
(c) Parallel.
(d) Spiculated.

11a. A 40-year-old woman presents for diagnostic work-up of new calcifications seen on baseline screening mammogram. Which is the appropriate term to describe this calcification pattern?
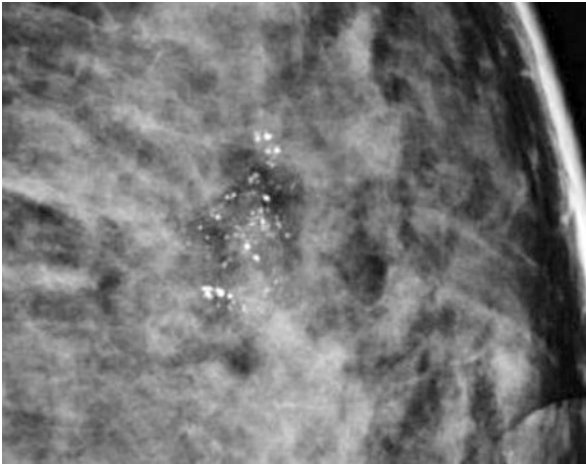
(a) Fine pleomorphic.
(b) Milk of calcium.
(c) Rod like.
(d) Dystrophic.

11b. What is the appropriate BI-RADS category for these calcifications?
   (a) BI-RADS Category 0.
   (b) BI-RADS Category 2.
   (c) BI-RADS Category 3.
   (d) BI-RADS Category 4.

11c. What is the most appropriate next step?
   (a) Return to annual screening mammogram.
   (b) Follow-up in 6 months.
   (c) Stereotactic biopsy.
   (d) Refer to surgery for excisional biopsy.

12a. A 55-year-old woman presents for her annual screening mammogram. What is the appropriate description for breast tissue density? [1]

   (a) Almost entirely fatty.
   (b) Scattered areas of fibroglandular density.
   (c) Heterogeneously dense.
   (d) Extremely dense.

12b. What is the most appropriate BI-RADS category for the calcifications seen on
     the screening mammogram?
     (a) BI-RADS Category 0.
     (b) BI-RADS Category 2.
     (c) BI-RADS Category 3.
     (d) BI-RADS Category 4.

13a. A 50-year-old woman presents for diagnostic evaluation of calcifications
     detected on screening mammography. Which are the appropriate terms to
     describe the calcification morphology and distribution on the diagnostic mam-
     mogram below?
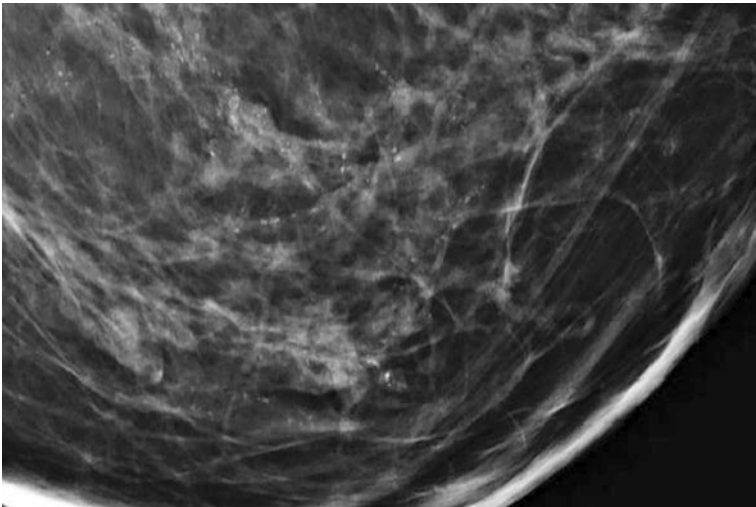
     (a) Fine linear branching, segmental.
     (b) Popcorn, grouped.
     (c) Large rod-like, linear.
     (d) Ground glass, diffuse.

13b. What is the appropriate BI-RADS category for the above finding?
     (a) BI-RADS Category 2.
     (b) BI-RADS Category 3.
     (c) BI-RADS Category 4.
     (d) BI-RADS Category 6.

14a. A 58-year-old woman presents for diagnostic evaluation of a palpable mass in
the right breast.
The calcifications span over 3 cm. The distribution of these calcifications is
best described as:
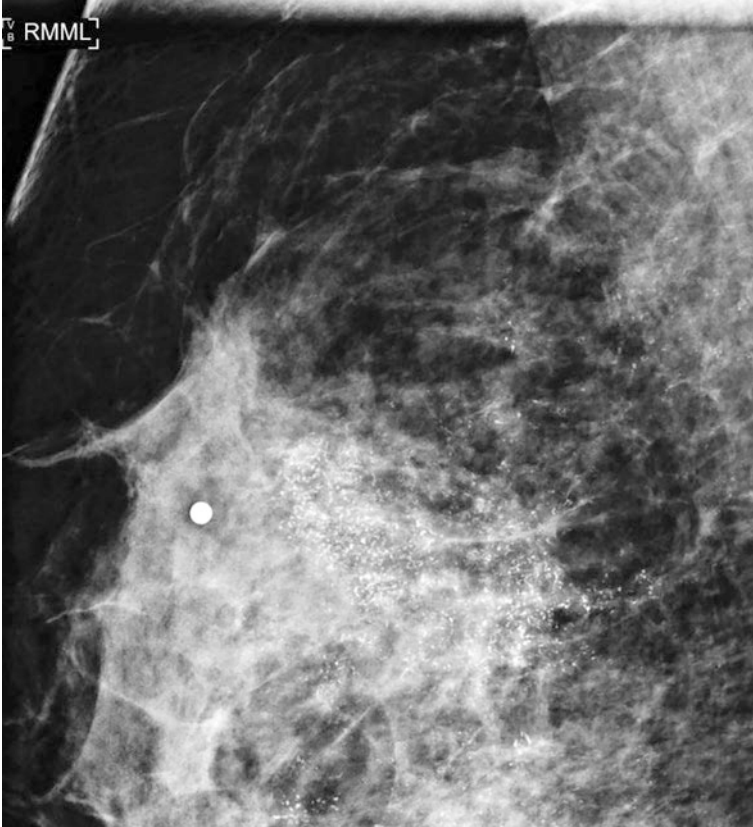
(a) Grouped.
(b) Clumped.
(c) Regional.
(d) Extensive.

14b. Breast ultrasound of the palpable mass was obtained, shown below. Which ultrasound descriptors best characterize this mass?
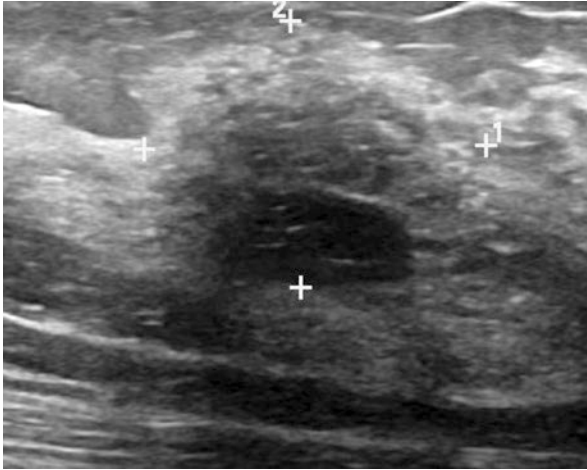
    (a) Circumscribed, posterior enhancement.
    (b) Microlobulated, posterior enhancement.
    (c) Indistinct, posterior shadowing.
    (d) Angular, posterior shadowing.

14c. MRI was obtained for further evaluation, shown below. Which of the following best describes the finding and enhancement characteristics?
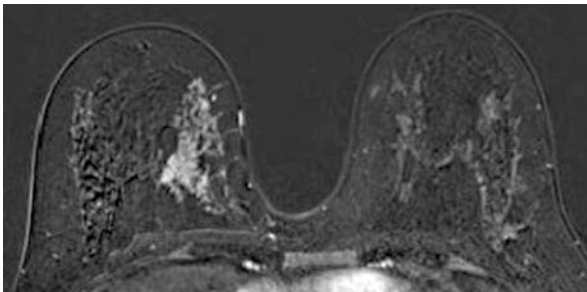
    (a) Irregular mass, homogenous enhancement.
    (b) Spiculated mass, rim enhancement.
    (c) Focal non-mass enhancement.
    (d) Segmental non-mass enhancement.

15a. A 42-year-old woman presents with a palpable mass in the left breast. Ultrasound evaluation of the mass was performed, shown below. Which ultrasound descriptors best characterize this mass?
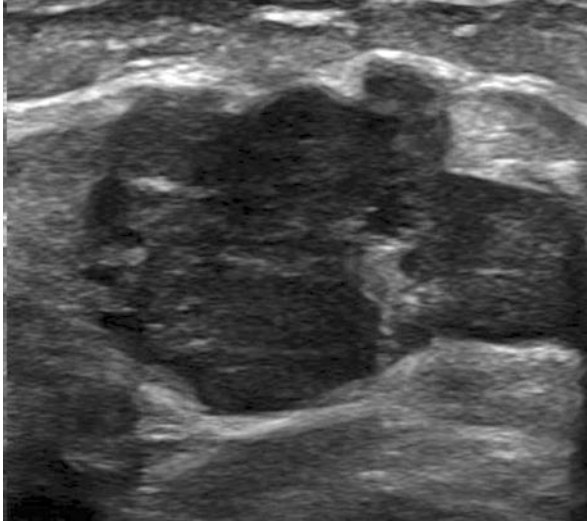
    (a) Indistinct, complex cystic and solid, no posterior features.
    (b) Spiculated, heterogenous, posterior shadowing.
    (c) Circumscribed, anechoic, posterior enhancement.
    (d) Microlobulated, hypoechoic, combined posterior enhancement, and shadowing.

15b. MRI was performed for further evaluation, shown below. Axillary ultrasound showed enlarged lymph nodes. What is the appropriate BI-RADS category?
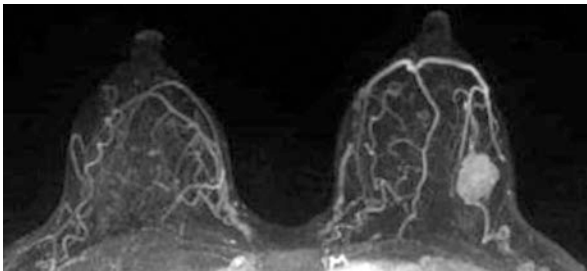
    (a) BI-RADS Category 2.
    (b) BI-RADS Category 3.
    (c) BI-RADS Category 5.
    (d) BI-RADS Category 6.

16. A 45-year-old woman presents for diagnostic tomosynthesis for a palpable abnormality, which revealed a breast mass as shown below. Which of the following features increases suspicion for malignancy in this patient?
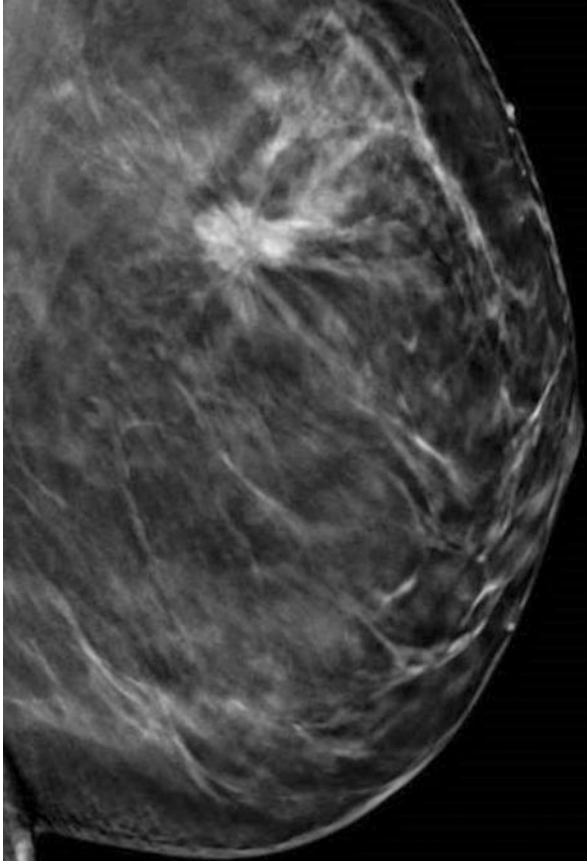
(a) Spiculations.
(b) Nipple retraction.
(c) Calcifications.
(d) Skin thickening.

17a. A 46-year-old woman presents for diagnostic evaluation for findings on her screening mammogram. Ultrasound evaluation was performed. Which ultrasound descriptors best characterize this mass?
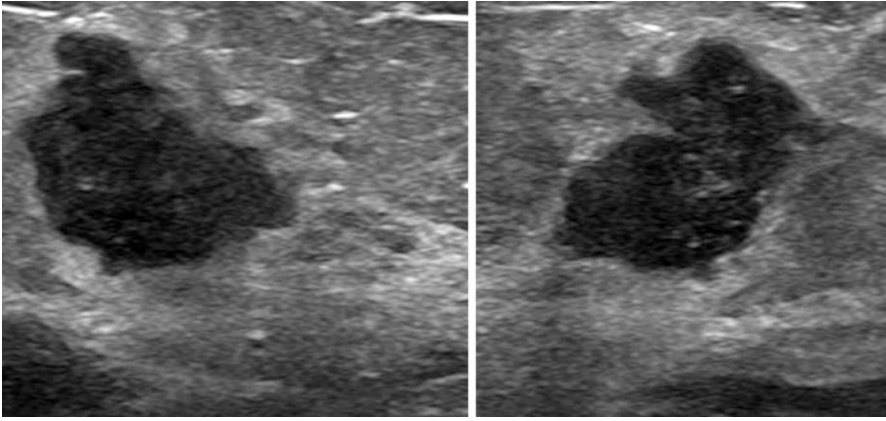
(a) Parallel, circumscribed.
(b) Not parallel, angular.
(c) Parallel, spiculated.
(d) Not parallel, indistinct.

17b. MRI was obtained for further evaluation, shown below. Which of the following best describes the finding and enhancement characteristics in the right breast?
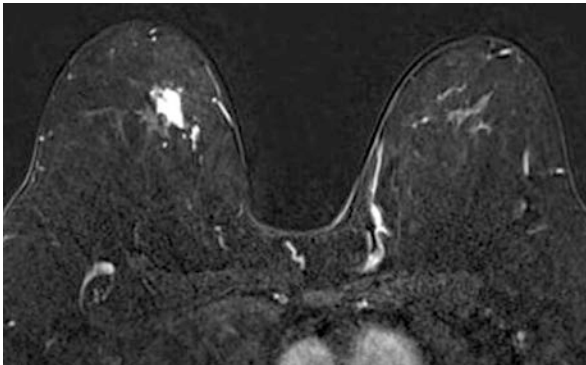

(a) Round circumscribed mass with rim enhancement.
(b) Focal non-mass enhancement.
(c) Irregular mass with homogeneous enhancement.
(d) Linear non-mass enhancement.

18a. A 27-year-old woman presents for diagnostic evaluation of a palpable abnormality in the right breast. Ultrasound was performed, shown below. Which of the following best characterizes this finding?
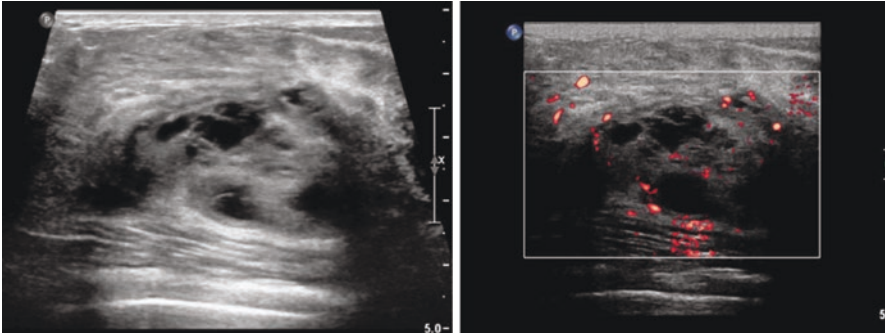
    (a) Clustered microcysts.
    (b) Arteriovenous malformation.
    (c) Microlobulated mass.
    (d) Complex cystic and solid mass.

18b. What is the appropriate BI-RADS category?
    (a) BI-RADS Category 1.
    (b) BI-RADS Category 2.
    (c) BI-RADS Category 3.
    (d) BI-RADS Category 4.

19. A 51-year-old female presents with a palpable abnormality in the superior aspect of the right breast, indicated by the arrow. Mammogram and ultrasound were performed, shown below. What is the appropriate BI-RADS category?
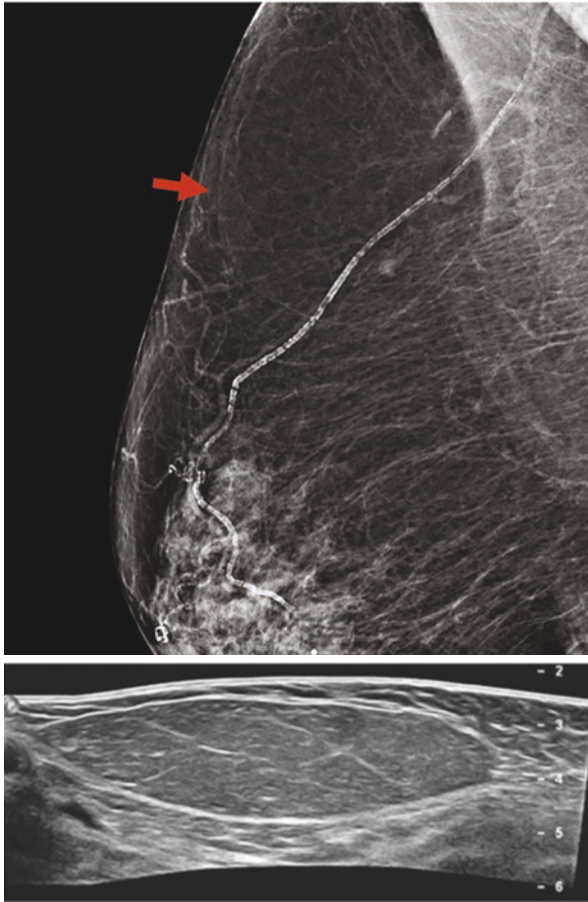

(a) BI-RADS Category 2.
(b) BI-RADS Category 3.
(c) BI-RADS Category 4a.
(d) BI-RADS Category 4c.

20. A 60-year-old woman presents for breast MRI for further evaluation of calcifications seen on mammography. Which of the following best describes the finding and enhancement characteristics in the left breast?
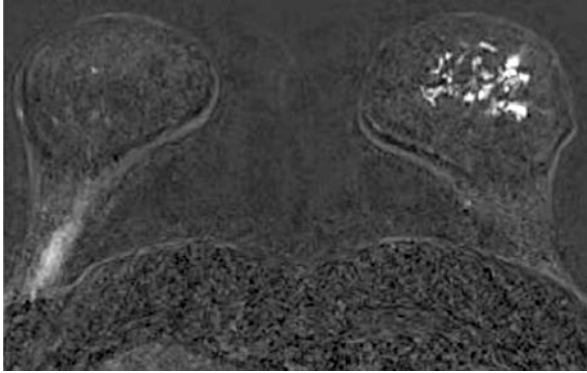
   (a) Irregular mass with dark internal septations.
   (b) Regional clumped non-mass enhancement.
   (c) Round mass with heterogenous enhancement.
   (d) Focal non-mass enhancement.

21. A 36-year-old woman presents with a palpable mass in the breast. Ultrasound evaluation was performed, shown below. What is the appropriate BI-RADS category for this finding?

    (a) BI-RADS Category 2.
    (b) BI-RADS Category 3.
    (c) BI-RADS Category 4.
    (d) BI-RADS Category 5.

22a. A patient presents for diagnostic evaluation for calcifications seen on a screening mammogram. Diagnostic mammogram (CC and ML views) and ultrasound correlate are shown below. Which of the following best describes the calcifications seen on mammogram?
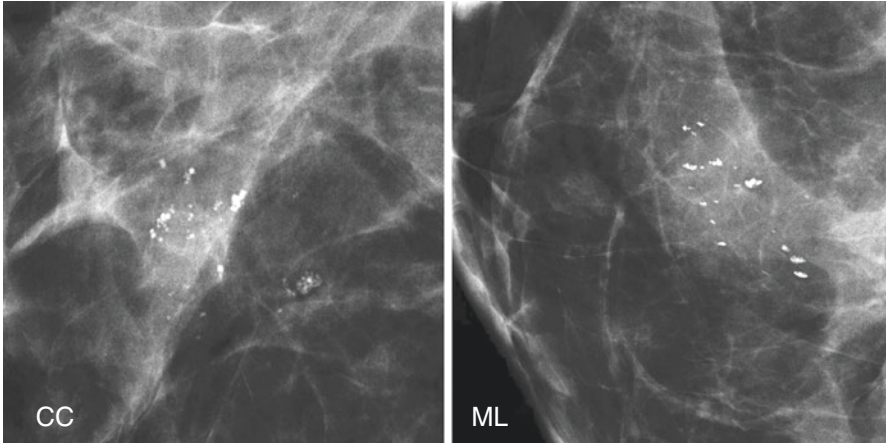
    (a) Fine linear branching.
    (b) Milk of calcium.
    (c) Rod like.
    (d) Dystrophic.

22b. Which of the following best describes the findings on ultrasound?
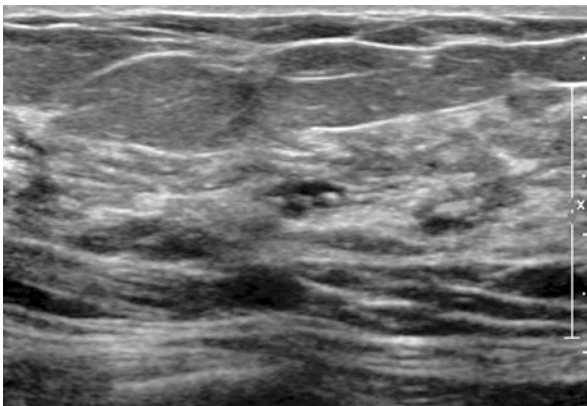
    (a) Clustered microcysts.
    (b) Anechoic simple cyst.
    (c) Indistinct hypoechoic mass.
    (d) Spiculated heterogenous mass.

22c. What is the most appropriate BI-RADS category for this finding?
    (a) BI-RADS Category 0.
    (b) BI-RADS Category 3.
    (c) BI-RADS Category 5.
    (d) BI-RADS Category 6.

23. A patient underwent CT chest following a motor vehicle collision, and a mass was found in the right breast, shown on coronal projections below. The patient has a large amount of bruising in the area of the mass seen on ultrasound. A follow-up ultrasound was obtained, shown below. What is the appropriate BI-RADS category for this finding?
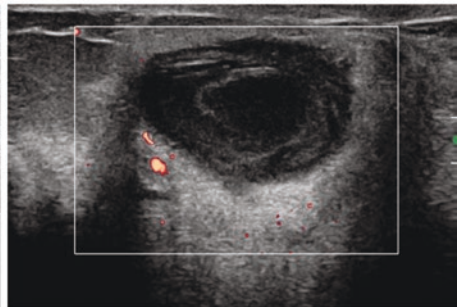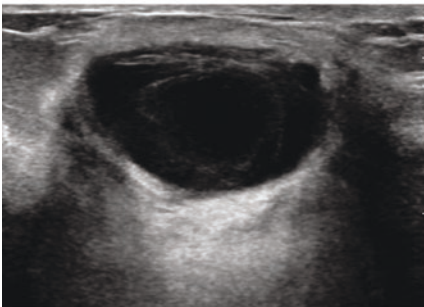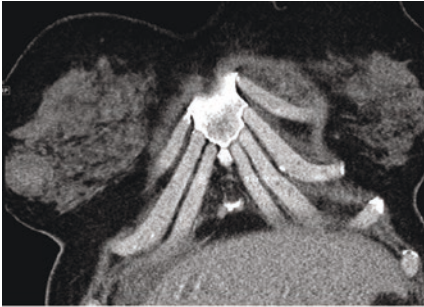
    (a) BI-RADS Category 0.
    (b) BI-RADS Category 2.
    (c) BI-RADS Category 3.
    (d) BI-RADS Category 4.

24. A patient presents for breast MRI for further evaluation of a biopsy-proven malignancy in the left breast, shown below. What is the appropriate BI-RADS category for the MRI of the known malignancy shown?
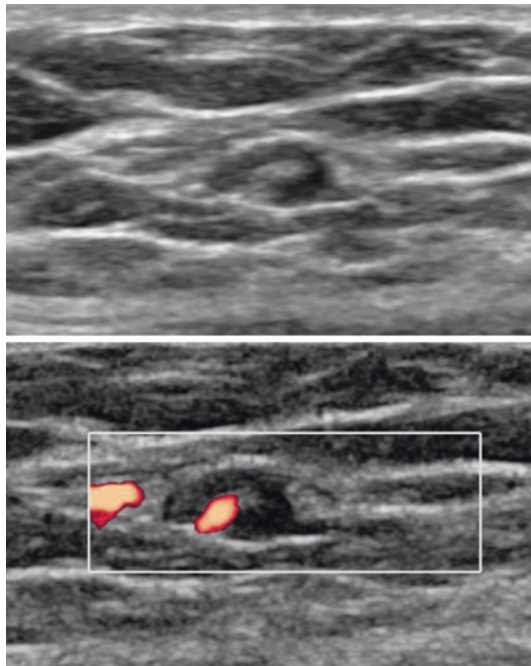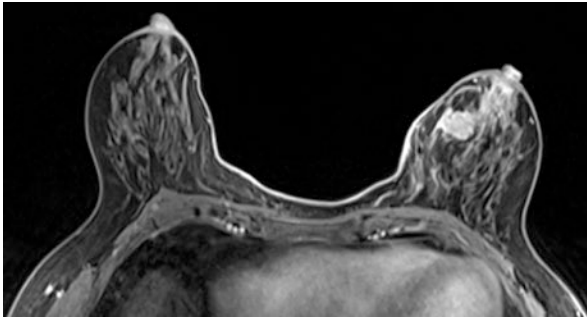

    (a) BI-RADS Category 3.
    (b) BI-RADS Category 4.
    (c) BI-RADS Category 5.
    (d) BI-RADS Category 6.

25a. A 73-year-old woman presents with a palpable abnormality in the left breast, ultrasound is shown below. Which of the following ultrasound features is demonstrated?

   (a) Oval shape.
   (b) Posterior acoustic enhancement.
   (c) Indistinct margins.
   (d) Spiculated margins.

25b. What is the appropriate BI-RADS category for this finding?
   (a) BI-RADS Category 2.
   (b) BI-RADS Category 3.
   (c) BI-RADS Category 4.
   (d) BI-RADS Category 6.

 26. What is one of the advantages of utilizing screening tomosynthesis over screening mammography?
   (a) Screening tomosynthesis can help differentiate cysts from masses.
   (b) Screening tomosynthesis has a higher sensitivity in detecting calcifications.
   (c) Screening tomosynthesis can help differentiate true asymmetries from superimposition of normal breast tissue.
   (d) Screening tomosynthesis can replace the need for further diagnostic work-up of calcifications due to improved visualization.

27a. A 55-year-old woman was recalled for further evaluation of calcifications seen on a screening mammogram (indicated by the arrow on tomosynthesis slice 1/50). Based on the diagnostic mammogram images provided, what is the most appropriate BI-RADS category for the calcifications?
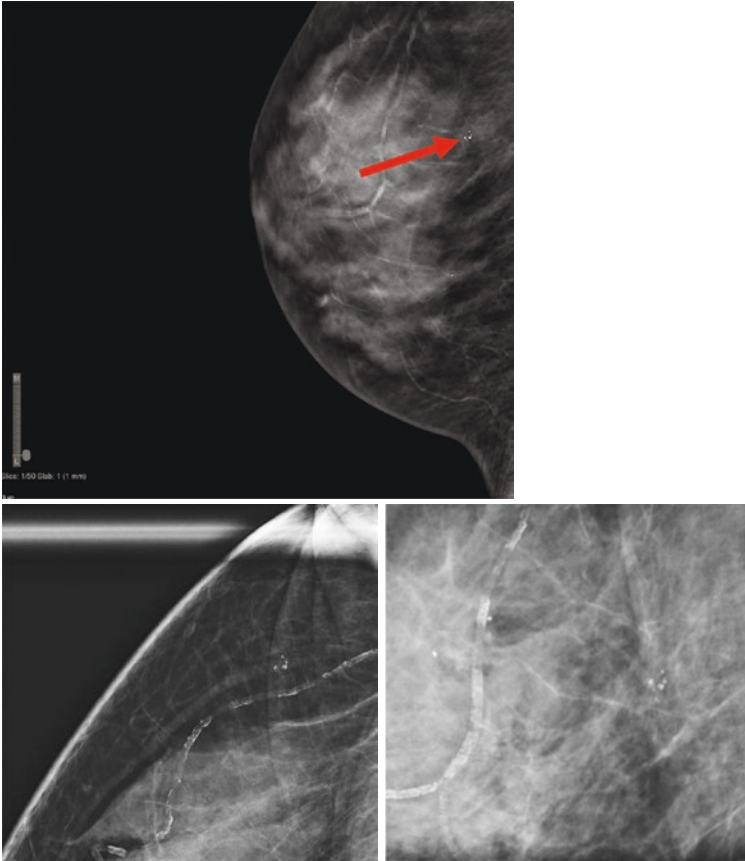
    (a) BI-RADS Category 0.
    (b) BI-RADS Category 2.
    (c) BI-RADS Category 3.
    (d) BI-RADS Category 4.

27b. What is the most appropriate next step?
    (a) Follow-up in 6 months.
    (b) Stereotactic biopsy.
    (c) Refer to surgery for excisional biopsy.
    (d) Return to routine screening mammogram.

28. Which of the following scenarios should **NOT** receive BI-RADS assessment category 3?
    (a) Solitary group of punctate calcifications on mammography.
    (b) Indeterminate finding.
    (c) A finding with greater than 0% but ≤2% likelihood of malignancy.
    (d) Oval circumscribed mass with parallel orientation.
    (e) A complicated cyst.

29. What is the recommended length of follow-up for a finding receiving BI-RADS assessment category 3?
    (a) Until the finding decreases in size.
    (b) 1–2 years of stability.
    (c) 2–3 years of stability or until any time that the radiologist deems it benign.
    (d) 2–4 years of stability or until the finding increases in size.

30. A screening mammogram is negative for malignancy, however, there is a suggestion of implant rupture and MRI is recommended. What is the appropriate BI-RADS assessment category for the screening mammogram?
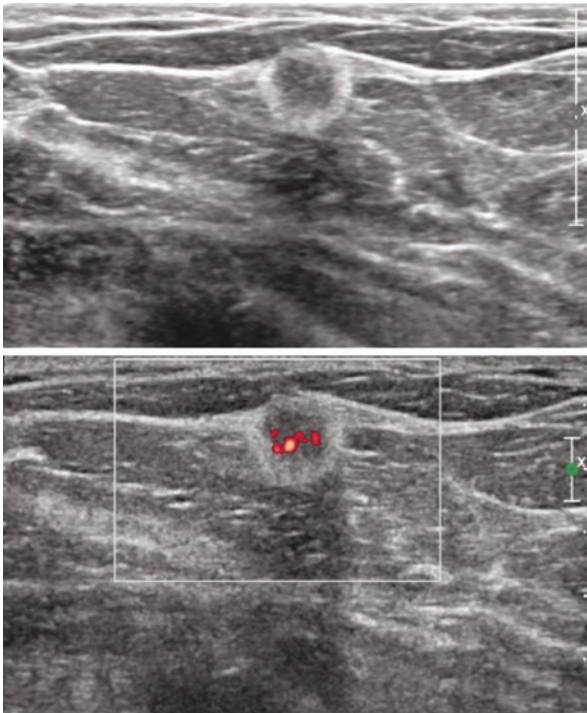   (a) BI-RADS Category 0.
    (b) BI-RADS Category 2.
    (c) BI-RADS Category 3.
    (d) BI-RADS Category 4.

31. You are interpreting a breast MRI for a patient with a known malignancy in the right breast, confirmed by recent ultrasound-guided biopsy. In addition to the known malignancy, the breast MRI demonstrates a suspicious mass in the left breast. What is the final overall BI-RADS assessment category?
    (a) BI-RADS Category 0.
    (b) BI-RADS Category 2.
    (c) BI-RADS Category 3.
    (d) BI-RADS Category 4.
    (e) BI-RADS Category 6.

32. A patient with known malignancy undergoes MRI following neoadjuvant chemotherapy. The mass seen on the MRI before chemotherapy has now resolved and the MRI does not demonstrate any suspicious mass or area of abnormal enhancement. What is the most appropriate BI-RADS assessment category?
    (a) BI-RADS Category 0.
    (b) BI-RADS Category 1.
    (c) BI-RADS Category 2.
    (d) BI-RADS Category 3.
    (e) BI-RADS Category 4.
    (f) BI-RADS Category 6.

33. Which of the following terms is used to describe a discrete area of fibroglan-
    dular density that is visible on only one mammographic projection?
    (a) Asymmetry.
    (b) Focal asymmetry.
    (c) Mass.
    (d) Architectural distortion.

34. Two years ago, a 43-year-old woman underwent diagnostic work-up of an
    asymmetry seen on prior screening examination, and the finding was deter-
    mined to be superimposition of normal fibroglandular tissue. She presents
    again today for screening mammogram. The asymmetry is seen again, and is
    now larger and more conspicuous than on prior examination. What is the most
    appropriate BI-RADS category for today's screening examination?
    (a) BI-RADS Category 0.
    (b) BI-RADS Category 2.
    (c) BI-RADS Category 3.
    (d) BI-RADS Category 4.

35. A woman presents for her screening mammogram in 2017 which was assigned
    BI-RADS 1, shown below. She presented 3 years later for screening mammo-
    gram, shown below. Which of the following best describes the finding?

    2017
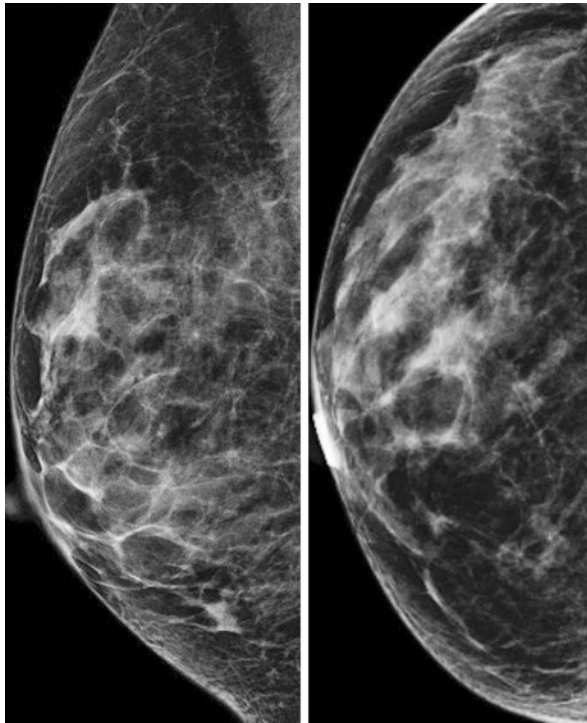
2020
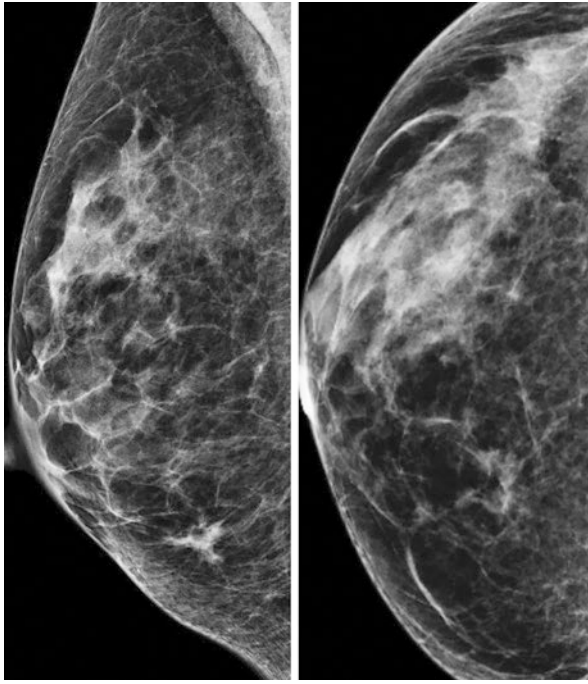
(a) Asymmetry.
(b) Global asymmetry.
(c) Developing asymmetry.
(d) Focal asymmetry.

Answers

1. d. A—popcorn; B—vascular; C—rod-like; D—rim.

   Popcorn calcifications are large, dense, and well-defined produced by involuting fibroadenomas. Vascular calcifications are linear calcifications that form parallel tracks, which are formed within the wall of the blood vessel. Large rod-like calcifications are benign calcifications that are formed within ectatic ducts, and are associated with plasma cell mastitis. They are thick and linear, and may be branching. As opposed to fine linear branching calcifications, they are usually >1 mm in diameter. Rim, or eggshell, calcifications are thin benign calcifications that conform to the shape of an oval or sphere, and contain central lucency. They are usually less than 1 mm in thickness, and are associated with fat necrosis, oil cysts, or simple cysts [2, 3].

2. d. A—suture; B—round; C—coarse heterogeneous; D—dystrophic; E—amorphous.

   Suture calcifications are benign, smooth, linear, or curvilinear (often forming loops), which can be seen after breast surgery and radiation if suture material does not fully resorb, forming a nidus for calcification. Coarse heterogeneous calcifications are irregular, conspicuous microcalcifications that are usually 0.5–1 mm. Coarse heterogeneous calcifications can be benign or malignant. Round calcifications are typically benign calcifications formed in the acini of the terminal ductal lobular units, and include punctate calcifications but can also be >0.5 mm. Dystrophic calcifications are benign calcifications with an irregular, coarse, or "lava-shaped" appearance and typically >1 mm. They can be seen following trauma or radiation. Amorphous calcifications are small, powdery, indistinct or cloud-like calcifications, which do not conform to a distinct shape [2].

3. b. A—diffuse; B—grouped; C—linear; D—segmental; E—regional.

   Grouped distribution is defined as a cluster of at least 5 calcifications within 1 cm from each other, in an area at most 2 cm in greatest linear dimension. Segmental distribution is defined as corresponding to ducts and branches of a segment or lobe. Regional distribution is greater than 2 cm, can occupy greater than one quadrant, and do not correspond with the expected distribution of a ductal unit. Diffuse distribution is defined as scattered randomly throughout the breast. Linear distribution is suggestive of deposition along ducts, and similar to segmental distribution, however, less extensive [2].

4. b. Architectural distortion.

An asymmetry is a discrete area of fibroglandular density that is visible on only one mammographic projection. Architectural distortion is an area of parenchymal distortion (spiculations radiating from a point, focal retraction, or straightening at the edge of the parenchyma), which is not associated with a mass. Architectural distortions are suspicious findings in the absence of trauma or prior surgery. Focal density and geographic abnormality are not terms included in the BI-RADS atlas [2].
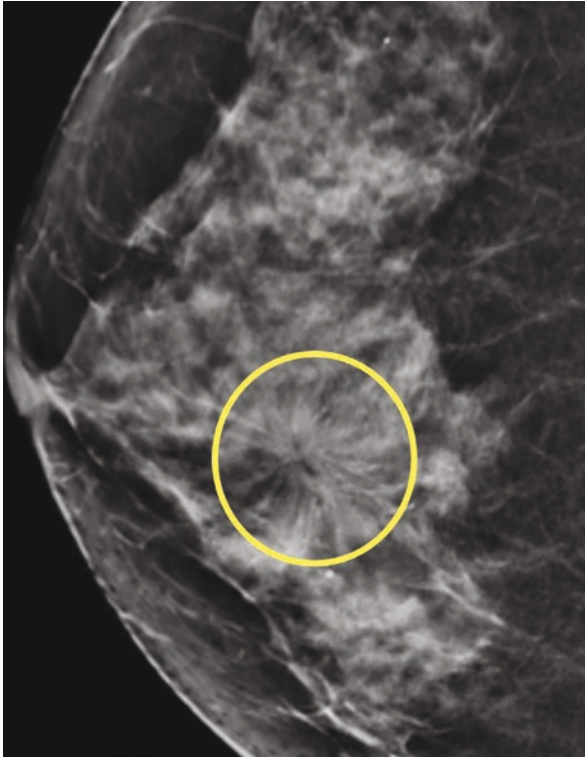
5. c. >10% to ≤50%.

A BI-RADS Category 4B corresponds with a moderate level of suspicion for malignancy and has a >10% to ≤50% likelihood of malignancy. BI-RADS Category 4A corresponds with a low level of suspicion for malignancy and has a >2% to ≤10% likelihood of malignancy. BI-RADS Category 4C corresponds with a high level of suspicion for malignancy and has a >50% to <95% likelihood of malignancy [2].

6. a. A—irregular; B—oval; C—round.

The shape of mass A is irregular, which is a suspicious finding. The shape of mass B is oval. The shape of mass C is round. Ovoid is not a term used in the BI-RADS atlas [2, 4].

7. b. A—circumscribed; B—indistinct; C—microlobulated; D—obscured.

The margins of mass A are circumscribed, defined as more than 75% of the circumference being well defined. The margins of mass B are indistinct, defined as none of the circumference being well defined, which is usually a suspicious finding. The margins of mass C are microlobulated, defined as small undulations along the borders, which is usually a suspicious finding. The margins of mass D are obscured, defined as more than 25% of the circumference hidden by adjacent fibroglandular tissue [2].

8. b. Hyperechoic.

The mass shown is uniformly brighter than the subcutaneous fat, therefore it is hyperechoic [2, 4].

9. a. Circumscribed.

The finding has circumscribed margins, rather than indistinct or spiculated margins. Parallel is a term used to describe orientation, not margins. The finding is anechoic and circumscribed, consistent with a benign simple cyst [2, 4].

10. d. Spiculated.

The mass has a stellate appearance, consistent with a spiculated mass [2, 4].

11a. a. Fine pleomorphic.

Fine pleomorphic calcifications vary in shape and size, and are more conspicuous than amorphous calcifications, with the appearance of "shards of glass" or "crushed stone." Pleomorphic calcifications are suspicious for malignancy, but can also be seen with high risk lesions such as atypical ductal hyperplasia or benign etiologies such as fibrocystic change [2].

11b. d. BI-RADS Category 4.

BI-RADS 4 is the category for findings that are "suspicious for malignancy" (2–94% probability of malignancy). The calcifications are fine-pleomorphic and grouped, and therefore suspicious for malignancy. Biopsy is indicated for the findings [2].

11c. c. Stereotactic Biopsy.

Return to annual screening mammogram and follow-up in 6 months would not be appropriate in this case because the calcifications are suspicious for malignancy. Stereotactic biopsy would be the appropriate next step for further

work-up. Excisional biopsy is not indicated for initial tissue sampling, as the calcifications are well visualized on mammogram and can be targeted with stereotactic biopsy [2].

12a. b. Scattered areas of fibroglandular density.

The mammogram demonstrates scattered areas of fibroglandular density. See below for examples of almost entirely fatty, heterogeneously dense, and extremely dense. Heterogeneously dense breasts may obscure small masses, and extremely dense breasts lower the sensitivity of mammography [3].

Almost entirely fatty	Scattered areas of fibroglandular density	Heterogeneously dense	Extremely dense
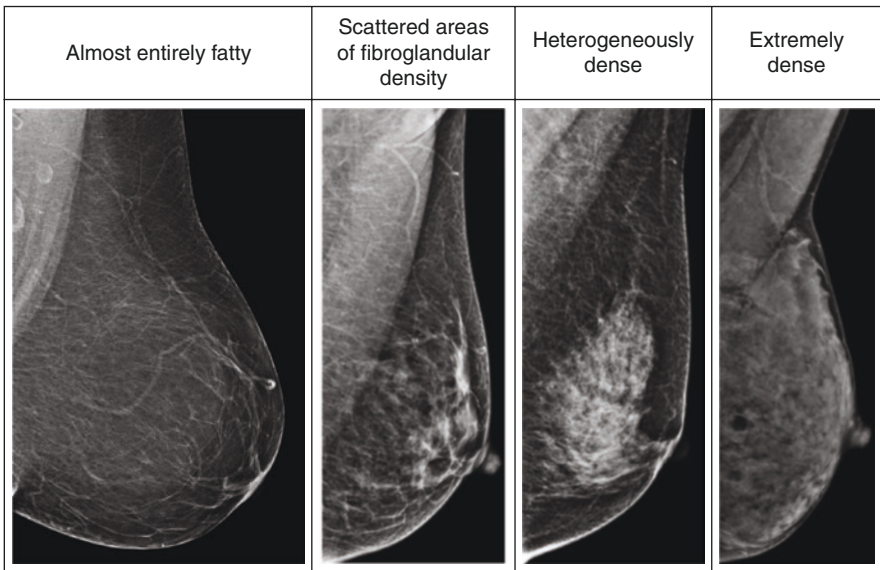
12b. b. BI-RADS Category 2.

The calcifications are diffuse, and are seen along the skin surface, consistent with benign dermal calcifications. Additional diagnostic imaging is not needed in this case, and so BI-RADS 2 is the appropriate category [2].

13a. a. Fine linear branching, segmental.

Fine linear branching calcifications are thin (<0.5 mm), linear or curvilinear irregular calcifications associated with filling, or "casting" of a duct. Fine linear branching calcifications are suggestive of malignancy. Segmental distribution is defined as corresponding to ducts and branches of a segment or lobe. The calcifications are fine linear branching and segmental, and are suspicious for malignancy [2]. Ground glass is not a BI-RADS term.

13b. c. BI-RADS Category 4.

The calcifications are fine linear branching in a segmental distribution. Both the morphology and the distribution are suspicious for malignancy. Biopsy is indicated (BI-RADS 4) [2].

14a. c. Regional.

These fine pleomorphic calcifications are best described as regional from the following choices. Regional distribution describes a large area of calcifications greater than 2 cm. Extensive is not part of the BI-RADS lexicon for calcification distribution. Clumped is an internal enhancement pattern used to describe non-mass enhancement in breast MRI [2].

14b. c. Indistinct, posterior shadowing.

The margins of the mass are indistinct, and not clearly demarcated from the surrounding tissue. In addition, the mass is heterogeneous in echogenicity, with punctate calcifications, and posterior acoustic shadowing, all of which are suspicious features [2, 4].

14c. d. Segmental non-mass enhancement.

The MRI demonstrates non-mass enhancement and does not meet criteria for a mass, as there are ill-defined and non-convex borders. Non-mass enhancement is also defined as having areas of intervening fat. The distribution of non-mass enhancement is best characterized as segmental, as it has a triangular or conical appearance with the apex directed toward the nipple, suggestive of ductal involvement. Focal distribution of non-mass enhancement is characterized to an area < 25% of a breast quadrant, and the image is more consistent with segmental distribution [2].

15a. d. Microlobulated, hypoechoic, combined posterior enhancement, and shadowing.

Although the shape of this mass is irregular, the margins of the mass would be considered microlobulated rather than spiculated. The mass is predominately hypoechoic, and there is combined posterior shadowing and enhancement. These features increase suspicion for malignancy. A circumscribed, anechoic mass with posterior enhancement would be consistent with a simple cyst. The margins of the mass can be outlined, and are therefore not indistinct [2, 4].

15b. c. BI-RADS Category 5.

MRI demonstrates an enhancing irregular mass in the left breast, which makes this mass highly suspicious for malignancy [2].

16. a. Spiculations.

The mass demonstrates spiculated margins, or lines radiating from the mass. Spiculations implies a suspicious finding. Although nipple retraction can be associated with malignancy, there is no definite nipple retraction seen here. There are no definite calcifications seen here. The skin in this patient is normal in appearance [2].

17a. b. Not parallel, angular.

The mass is taller than wide, and is not parallel. The mass has sharp angular margins. These findings are suspicious for malignancy. Parallel masses are wider than tall. Spiculated margins are characterized as having sharp lines that radiate from the mass. Indistinct margins are characterized by having a poorly defined margin which is not clearly demarcated from the surrounding tissue [2, 4].

17b. c. Irregular mass with homogeneous enhancement.

The mass in the right breast has irregular margins, and uniform homogeneous internal enhancement. The mass in the right breast is not round and circumscribed. The finding in the right breast would not be considered non-mass enhancement, as it is a space occupying lesion with convex borders [2].

18a. d. Complex cystic and solid mass.

The mass has both solid and cystic components, as well as internal vascularity. The margins of this mass are relatively smooth and circumscribed, rather than microlobulated. Clustered microcysts are more cystic than solid, with thin avascular septations. An arteriovenous malformation may have the appearance of a cystic and solid mass on grayscale ultrasound imaging, however, the cystic appearing components would have vascular flow, which is not seen here [2–4].

18b. d. BI-RADS Category 4.

Complex cystic and solid masses are suspicious for malignancy [2].

19. a. BI-RADS Category 2.

BI-RADS 2 is the category for benign findings. The finding is a circumscribed, isoechoic mass on ultrasound, which corresponds to a fat containing circumscribed mass on mammogram. The finding is most consistent with a lipoma, which is a benign finding [2].
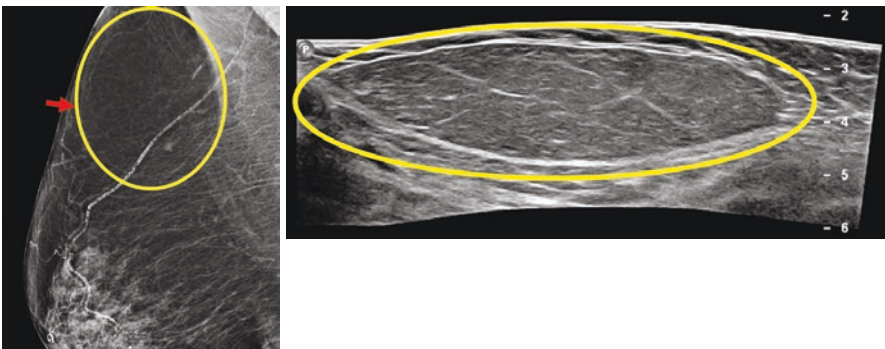
20. b. Regional clumped non-mass enhancement.

The finding does not meet criteria for a mass; it is not a space occupying lesion, there are no clear margins, and there are areas of intervening fat. Therefore, it is consistent with non-mass enhancement. Dark internal septations are typically benign and can be seen with fibroadenomas, but the appearance here is more consistent with areas of intervening fat. This finding is most consistent with non-mass enhancement, with a regional distribution. Regional distribution does not conform to a ductal or segmental pattern, but is larger than a focal distribution which is defined as <25% of a quadrant. Clumped non-mass enhancement describes enhancement of varying shapes with some confluent areas, as seen here. Clumped non-mass enhancement is a suspicious finding [2].

21. a. BI-RADS Category 2.

BI-RADS 2 is the category for benign findings. The ultrasound demonstrates a normal appearing lymph node, with a normal reniform appearance, normal echogenic fatty hilum with normal hilar vascular flow, and normal cortical thickness < 3 mm. Therefore, this is a benign finding [2].

22a. b. Milk of calcium.

Milk of calcium calcifications are benign calcification deposits within cysts. They often appear round, amorphous, or "smudged" on CC views, and crescent or "tea-cup" shaped on ML views, as they conform to the shape of cysts with positional changes. The calcifications are crescent shaped on ML view, and are associated with clustered microcysts, therefore consistent with milk of calcium [2].

22b. a. Clustered microcysts.

Clustered microcysts are clustered anechoic cystic masses, individually <2–3 mm, with thin intervening septations and no discrete solid component. The mass in the image is an example of clustered microcysts, and is also noted to contain punctate echogenic foci which represent calcifications, also seen on mammography [2].

22c. b. BI-RADS Category 3.

Clustered microcysts are typically associated with benign findings including fibrocystic change and apocrine metaplasia. They are often assessed as benign (Category 2), or probably benign (Category 3) if new or if there is diagnostic uncertainty [2]. If new, especially in a postmenopausal woman, the margins and associated calcifications should be carefully assessed [5].

23. b. BI-RADS Category 2.
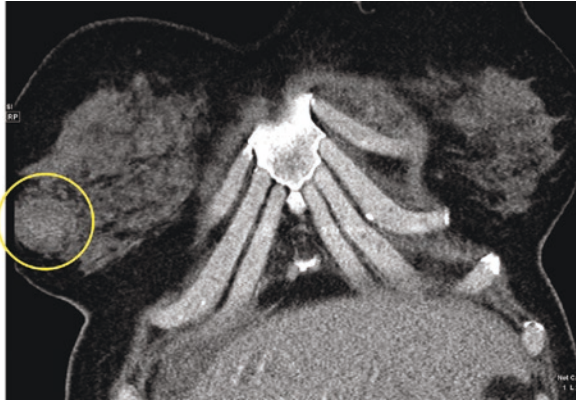
On CT, a mildly hyperattenuating mass is seen. This corresponds to a circumscribed mass with lace-like internal echogenicity on the ultrasound. The cyst is avascular, and internal echoes are in a pattern characteristic of a hematoma. Given the history of trauma and bruising, this mass represents a hematoma. Further imaging is not required for diagnostic evaluation. Hematomas are benign and usually self-resolving, and so BI-RADS 2 is the appropriate category [2].

24. d. BI-RADS Category 6.

BI-RADS 6 is the category for biopsy-proven malignancy, described in the question stem [2].

25a. c. Indistinct margins.

The mass is round. This mass demonstrates posterior acoustic shadowing, rather than enhancement. Posterior acoustic enhancement can be seen classically with simple cysts. The margins of the mass are indistinct, and demonstrates an echogenic rim or echogenic halo (a white band surrounding the mass). These findings raise suspicion for malignancy. Although these margins are indistinct, there are not clear spiculations arising from the mass [2, 4].

25b. c. BI-RADS Category 4.

BI-RADS 4 is the category for findings that are "suspicious for malignancy." This mass has suspicious features including, round shape, not parallel orientation, indistinct margins with an echogenic rim, posterior shadowing, and internal vascularity. Therefore, it is categorized as a BI-RADS 4 lesion [2].

26. c. An asymmetry may represent a true abnormality obscured by isodense fibroglandular tissue, or it may represent superimposition of normal breast tissue. Tomosynthesis slices can help to differentiate overlapping normal breast tissue [6].

    a. Although breast tomosynthesis can help delineate mass margins due to removal of superimposed breast tissue, tomosynthesis cannot definitively distinguish masses from cysts. Even masses with circumscribed margins should not be assumed to be benign (unless multiple and bilateral), and still require further evaluation with ultrasound [6].

    b. Early studies evaluating the performance of breast tomosynthesis have demonstrated no statistically significant difference in detection of calcifications [6].

    d. Calcifications may appear enhanced on tomosynthesis synthetic images, which are designed to preserve high-attenuating voxels. Synthesized images may also contain artifacts which may be mistaken for calcifications. Conversely, calcifications may appear less defined due to the arc pathway of the X-ray tube causing slight blurring of microcalcifications [6].

27a. b. BI-RADS Category 2.

    These calcifications appear slightly heterogeneous on the CC and ML magnification views however they are visualized on the first tomosynthesis slice as demonstrated on the tomosynthesis scroll bar therefore they are dermal calcifications. Dermal calcifications are benign and no further evaluation if required. Additional diagnostic imaging is not needed in this case, and so BI-RADS 2 is the appropriate category [2].

27b. d. Return to routine screening mammogram.

    Dermal calcifications are benign, so return to screening mammogram is the appropriate course. Follow-up in 6 months and biopsy are not indicated for benign calcifications [2].

28. b. Indeterminate finding.

    The BI-RADS atlas specifically states that BI-RADS Category 3 should not be used for indeterminate findings, such as findings where the radiologist cannot decide between BI-RADS Category 2 and BI-RADS Category 4. BI-RADS Category 3 is reserved for specific situations where the likelihood of malignancy is 0–2%, such as a solitary group of punctate calcifications on mammography or an oval circumscribed mass with parallel orientation seen on ultrasound. BI-RADS Category 2 or 3 is appropriate for a complicated cyst seen ultrasound [2].

29. c. 2–3 years of stability or until any time that the radiologist deems it benign.

    The BI-RADS atlas recommends 2–3 years of imaging follow-up for a probably benign finding that has received BI-RADS Category 3. The follow-up

interval is usually every 6 months for the first year, and then can continue every 6 months or be extended to annual follow-up. If, at any time, the interpreting radiologist determines the finding has 0% likelihood of malignancy, the assessment can be changed to BI-RADS Category 2 [2].

30. b. BI-RADS Category 2.

The BI-RADS assessment category is intended to describe the likelihood of malignancy. If there is concern for implant rupture but there is no mammographic evidence of malignancy, the correct assessment is BI-RADS Category 2, because implant rupture is a benign finding. The interpreting radiologist can then add a sentence recommending MRI to further evaluate the implant [2].

31. d. BI-RADS Category 4.

The final BI-RADS assessment category should be determined based on the most actionable item according to the following hierarchy, from lowest to highest: 1, 2, 3, 6, 0, 4, 5. The newly seen suspicious mass in the left breast (BI-RADS Category 4) is the most actionable finding and requires biopsy, and therefore the final overall BI-RADS assessment Category is 4. The known malignancy in the right breast (BI-RADS assessment Category 6) has already been confirmed and is known by the referring physician [2].

32. f. BI-RADS Category 6.

Even though there is no imaging abnormality on the MRI, the final assessment category should be BI-RADS 6. This situation is an exception to the central BI-RADS principle which states that the final assessment category should be assigned based on the imaging findings. Current practice dictates that even patients with a complete imaging response to therapy proceed with surgery. Therefore, it could cause confusion to the treatment team to provide a final assessment of negative or benign [2].

33. a. Asymmetry.

An asymmetry is a discrete area of fibroglandular density that is visible on only one mammographic projection [2].

34. a. BI-RADS Category 0.

BI-RADS Category 0 is the category for imaging that is incomplete or requires additional diagnostic imaging. Although an asymmetry most often reflect summation of normal fibroglandular tissue, when an asymmetry appears larger or more conspicuous than on previous examinations, the likelihood of malignancy is significantly increased. Such finding have been termed "developing asymmetry." Developing asymmetry on screening examination should be worked up further with diagnostic imaging, and so BI-RADS Category 0 is the most appropriate choice [2].

35. c. Developing asymmetry.

An asymmetry is a term to describe a discrete unilateral fibroglandular density which is seen in one or more projections, and that does not meet criteria for a mass. Asymmetries are further subdivided into the following categories: asymmetry, focal asymmetry, global asymmetry, and developing asymmetry. An asymmetry is seen in only one mammographic projection. A focal asymmetry is seen in two mammographic projections. A global asymmetry is visible in two mammographic projections and involves more than one quadrant. A developing asymmetry is a focal asymmetry that is enlarging or more conspicuous than on prior examinations. The case is an example of a developing asymmetry in the lower inner quadrant of the right breast [2, 3].

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