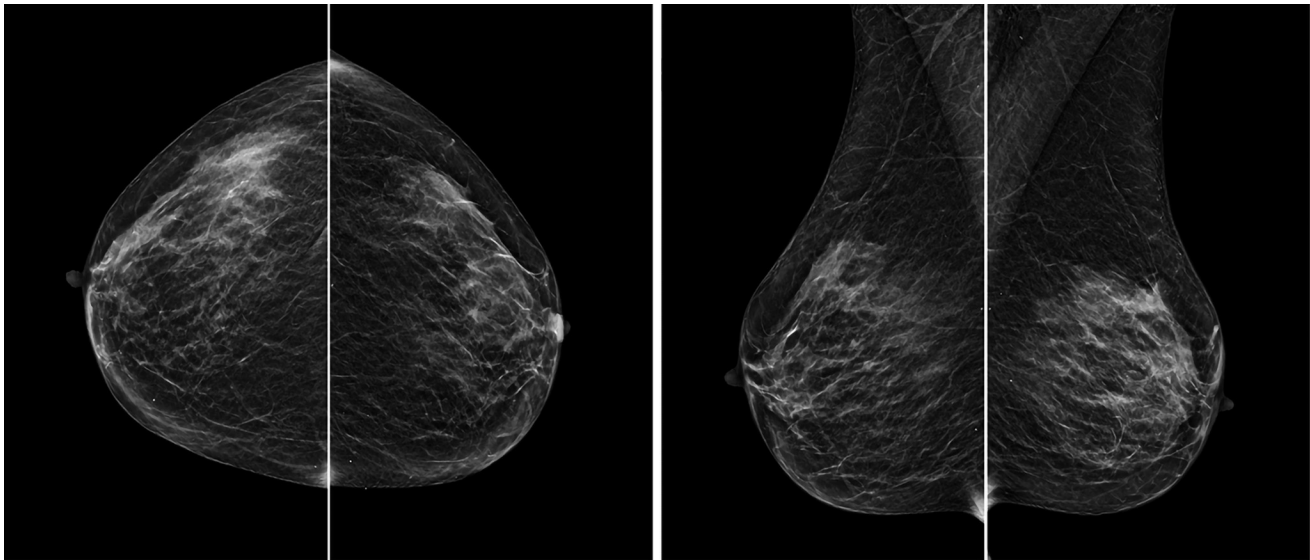


Case 1

Kiet V. Vo, Matthew D. Phelps, and Diana L. Lam

Refer to the following figure and answer the questions.



1.1 A 42-year-old patient had a screening mammogram that was interpreted as negative for malignancy. She returned 11 months later with a palpable mass, which was biopsied and was found to be malignant. How would the screening mammogram be classified in the breast imaging audit?

- A. False positive.
- B. False negative.
- C. True positive.
- D. True negative.

1.2 In the breast mammography audit, what is the best definition of “within 1 year”?

- A. A 12-month time period.
- B. A 12 + 1 month time period.
- C. A time period of 365 days.
- D. A time period of 365 + 1 days.

1.3 A 47-year-old patient was recommended for additional imaging workup for focal asymmetry seen on screening mammogram. She returned for diagnostic imaging, which showed that the focal asymmetry was consistent with superimposition of normal tissue. The patient had a screening mammogram the following year, which was negative for malignancy. How would the original screening mammogram be classified in the audit?

- A. False positive 1.
- B. False positive 2.
- C. False positive 3.
- D. True negative.

1.4 A 48-year-old presents with a palpable lump in the left breast 9 months after a negative screening mammogram. Upon diagnostic workup, there is a mass at the site of concern, and subsequent biopsy demonstrates invasive ductal carcinoma. What term best describes this situation?

- A. False positive.
- B. Screen-detected cancer.
- C. Interval cancer.
- D. Sentinel event.

1.5 A radiologist is reviewing their MQSA audit statistics for the prior year and notes that one metric, which denotes the percentage of positive biopsies for all recommended biopsies, is below the American College of Radiology (ACR) recommended benchmark. What is this metric?

- A. Positive predictive value 1 (PPV1).
- B. PPV2.
- C. PPV3.
- D. Cancer detection rate (CDR).

Answers and Explanations

1.1 Answer: B. False negative.

False negative is when there is tissue diagnosis of cancer within the normal screening interval, typically 1 to 2 years, of a negative examination (BI-RADS category 1 or 2 for screening and BI-RADS category 1, 2, or 3 for a diagnostic examination). There are generally three types of false positives (A) with an overarching theme of no known tissue diagnosis of cancer within the normal screening interval, typically 1 year, of a positive screening examination. A true positive (C) is a tissue diagnosis of cancer within the normal screening interval after a positive imaging examination. A true negative (D) is no known tissue diagnosis of cancer within a normal screening interval of a negative imaging examination.

1.2 Answer: A. A 12-month time period.

"Within 1 year" equates to a 12-month time period after the screening or diagnostic examination as defined by the Mammography Quality Standards Act (MQSA).

1.3 Answer: A. False positive 1.

This is also known as a false positive 1 (FP1) when there is no known tissue diagnosis of cancer within 1 year of a positive *screening* examination (BI-RADS category 0). A false positive 2 (FP2) is when there is no known tissue diagnosis of cancer within 1 year after recommendation for tissue diagnosis based on a positive *diagnostic* examination (BI-RADS category 4 or 5; B). False positive 3 (FP3) is when there is no known tissue diagnosis of cancer within 1 year after a biopsy has been performed (C). A true negative for the screening examination would have been recorded if the original screening mammogram was read as negative, showed no evidence of malignancy, after a normal screening interval (D).

1.4 Answer: C. Interval cancer.

An interval cancer (C) is defined as a cancer that is diagnosed within 12 months following a negative screening mammogram and is one of the important statistics defined by the Food and Drug Administration's MQSA audit. Interval cancers are

important to understand as they may indicate a missed cancer at the most recent screening mammogram or a rapidly progressing cancer that developed since the last screening. A false-positive examination (A) is either a screening mammogram recalled for further imaging that proves negative on diagnostic workup or a diagnostic examination for which biopsy was recommended that proves benign and concordant on tissue sampling. A screen-detected cancer (B) is a diagnosed cancer detected at screening. A sentinel event is a term defined by the Joint Commission and consists of a patient safety event that results in severe harm or death of the patient and is not an event monitored or defined by the Food and Drug Administration's MQSA audit.

1.5 Answer: C. PPV3.

PPV in the context of the MQSA audit has three definitions, which are important to understand. An easy way to understand the three PPVs is to remember "1 – screening, 2 – diagnostic, 3 – biopsy." PPV1 (A) is the percentage of all positive (recalled) screening mammograms that go on to tissue diagnosis of cancer within 1 year. PPV2 (B) is the percentage of all diagnostic examinations for which tissue diagnosis was recommended that result in cancer within 1 year. PPV3 (C) is the percentage of all recommended biopsies that result in tissue diagnosis of cancer within 1 year. CDR (D) is the number of diagnosed cancers per 1,000 screening mammograms, another important MQSA metric.

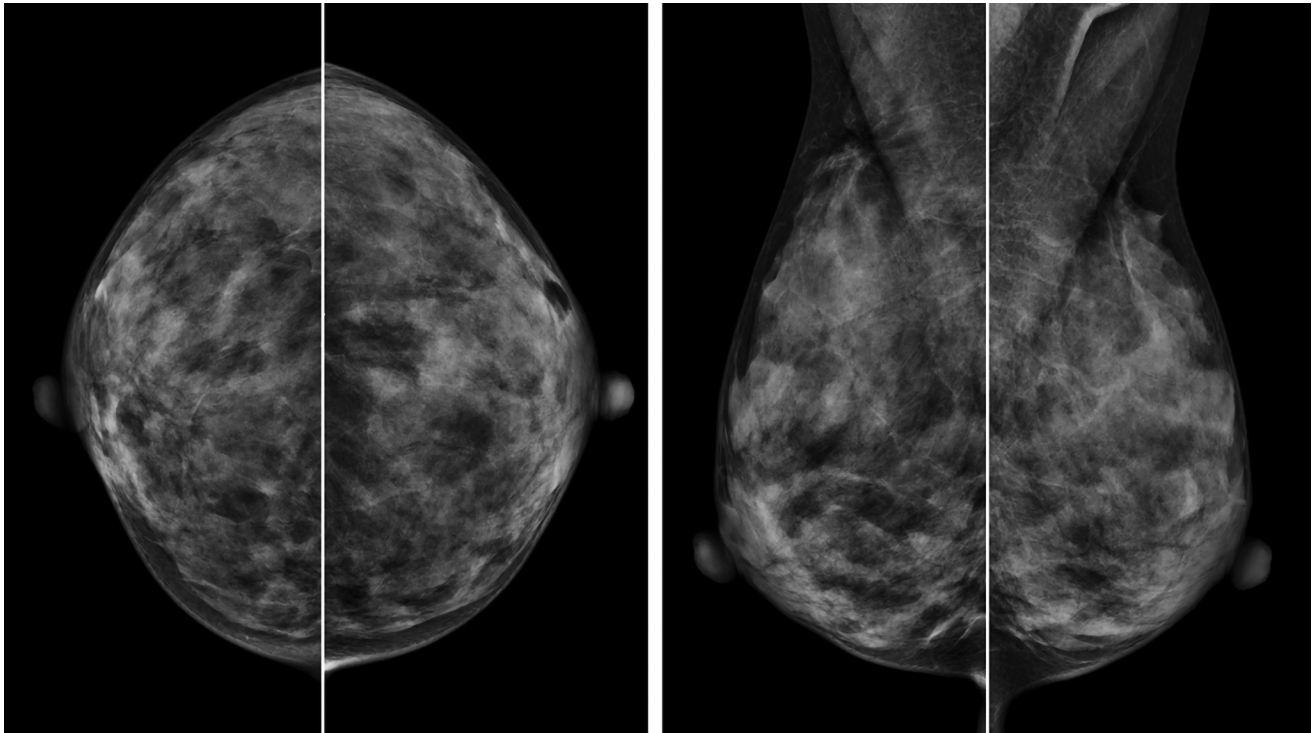
Suggested Readings

- D'Orsi CJ, Sickles EA, Mendelson EB, et al. ACR BI-RADS® Atlas: Breast Imaging Reporting and Data System. Reston, VA: American College of Radiology; 2013
- Duffy SW, Gabe R. What should the detection rates of cancers be in breast screening programmes? *Br J Cancer* 2005;92(3):597–600
- Saslow D, Boetes C, Burke W, et al. American Cancer Society guidelines for breast screening with MRI as an adjunct to mammography. *CA Cancer J Clin* 2007;57(2):75–89
- Sickles EA, D'Orsi CJ, Bassett LW, et al. ACR BI-RADS® mammography. In: ACR BI-RADS® Atlas, Breast Imaging Reporting and Data System. Reston, VA: American College of Radiology; 2013

Case 2

Lisa N. Johnson and Diana L. Lam

Refer to the following figure and answer the questions.



2.1 Bilateral craniocaudal (CC) and mediolateral oblique (MLO) views from a screening mammogram in a 41-year-old patient are presented. Which of the following is the appropriate BI-RADS category for this patient's breast composition?

- A. Category A.
- B. Category B.
- C. Category C.
- D. Category D.

2.2 On average, patients with dense breast tissue are at _____ increased risk of breast cancer compared to patients with nondense breasts?

- A. Zero times.
- B. One to five times.
- C. Six to 10 times.
- D. More than 10 times.

2.3 Which of the following does NOT result in the appearance of increased breast density?

- A. Aging.
- B. Invasive lobular carcinoma.
- C. Breast feeding.
- D. Weight loss.

Answers and Explanations

2.1 Answer: D. Category D.

This patient has extremely dense breasts; nearly the entire breast (>75%) is composed of dense tissue except for subcutaneous fat (D). The other answer choices correspond to the following BI-RADS density descriptors: (A) category A (breasts are almost entirely fatty), (B) category B (scattered areas of fibroglandular density), and (C) category C (heterogeneously dense).

2.2 Answer: B. One to five times increased risk.

According to a meta-analysis of studies that evaluated breast density as an independent risk factor for breast cancer, the relative risk was 4.64 for breasts that were 75% or more dense (category D) compared to fatty density (category A). The increased risk of breast cancer is independent of the decreased sensitivity of screening mammography in extremely dense breasts. There is 1.5 to 2.2×risk in dense breasts (categories C and D) versus nondense breasts (categories A and B).

2.3 Answer: A. Aging.

Breasts typically become less dense with aging due to normal fatty involution of breast tissue. Invasive lobular carcinoma (B) results in unilateral increased breast density in addition to a decrease in overall breast size, “shrinking breast.” Breast feeding (C) results in increased size and density of the breasts. Weight loss (D) decreases the size and subcutaneous fat content of the breasts, which results in increased breast density on imaging.

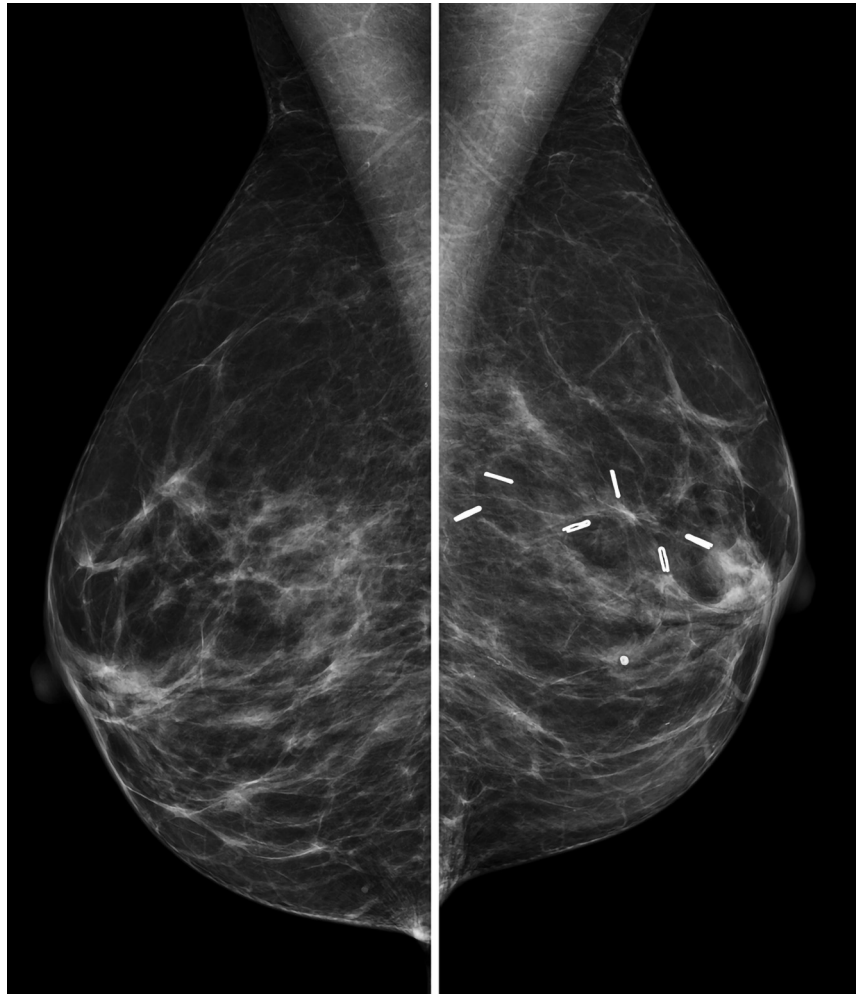
Suggested Readings

- D'Orsi CJ, Sickles EA, Mendelson EB, et al. ACR BI-RADS® Atlas, Breast Imaging Reporting and Data System. Reston, VA: American College of Radiology; 2013
- McCormack VA, dos Santos Silva I. Breast density and parenchymal patterns as markers of breast cancer risk: a meta-analysis. *Cancer Epidemiol Biomarkers Prev* 2006;15(6):1159–1169
- Østerås BH, Martinsen ACT, Gullien R, Skaane P. Digital mammography versus breast tomosynthesis: impact of breast density on diagnostic performance in population-based screening. *Radiology* 2019;293(1):60–68

Case 3

Kiet V. Vo and Diana L. Lam

Refer to the following figure and answer the questions.



3.1 Bilateral MLO views from a screening mammogram in a 55-year-old patient with remote history of breast cancer is presented. Which of the following is the best overall BI-RADS assessment category for this screening mammogram?

- A. BI-RADS category 0.
- B. BI-RADS category 1.
- C. BI-RADS category 2.
- D. BI-RADS category 3.

3.2 Based on the imaging findings for the above mammogram, what is the most appropriate recommendation?

- A. Short-term follow-up in 6 months.
- B. Ultrasound core needle biopsy.
- C. Stereotactic core biopsy.
- D. Routine screening mammography.

3.3 A 57-year-old patient with a personal history of breast cancer returns for annual screening mammogram. On a population basis, what is the sensitivity and specificity of detecting breast cancer on mammogram for individuals with personal history of breast cancer versus those without a personal history?

- A. Increased sensitivity, increased specificity.
- B. Increased sensitivity, decreased specificity.
- C. Decreased sensitivity, increased specificity.
- D. Decreased sensitivity, decreased specificity.

Answers and Explanations

3.1 Answer: C. BI-RADS category 2.

After lumpectomy, the usual mammographic appearance is interval appearance of architectural distortion caused by the surgery. Given there are postsurgical changes in the left breast from prior lumpectomy, a benign (BI-RADS category 2) assessment is the best answer (C). BI-RADS category 0 (A) is used when additional images need to be obtained. BI-RADS category 1 (B) would be appropriate if no postsurgical or other benign findings were present. BI-RADS category 3 (D) should be assessed following diagnostic imaging that demonstrates probably benign findings.

3.2 Answer: D. Routine screening mammography.

This screening mammogram demonstrates postlumpectomy changes in the left breast—BI-RADS category 2, benign. Therefore, routine screening mammography (D) is the appropriate recommendation. Short-interval follow-up (A) would be appropriate for a BI-RADS category 3 assessment from diagnostic breast imaging. Ultrasound (B) or stereotactic (C)

biopsies would be appropriate for BI-RADS category 4 or BI-RADS category 5 findings.

3.3 Answer: D. Decreased sensitivity, decreased specificity.

Large cohort studies from the Breast Cancer Surveillance Consortium show that screening sensitivity and specificity were lower in women with history of breast cancer than in women without such a history (65.4 vs. 76.5% and 98.3 vs. 99.0%, respectively). All other choices (A, B, and C) are incorrect variations.

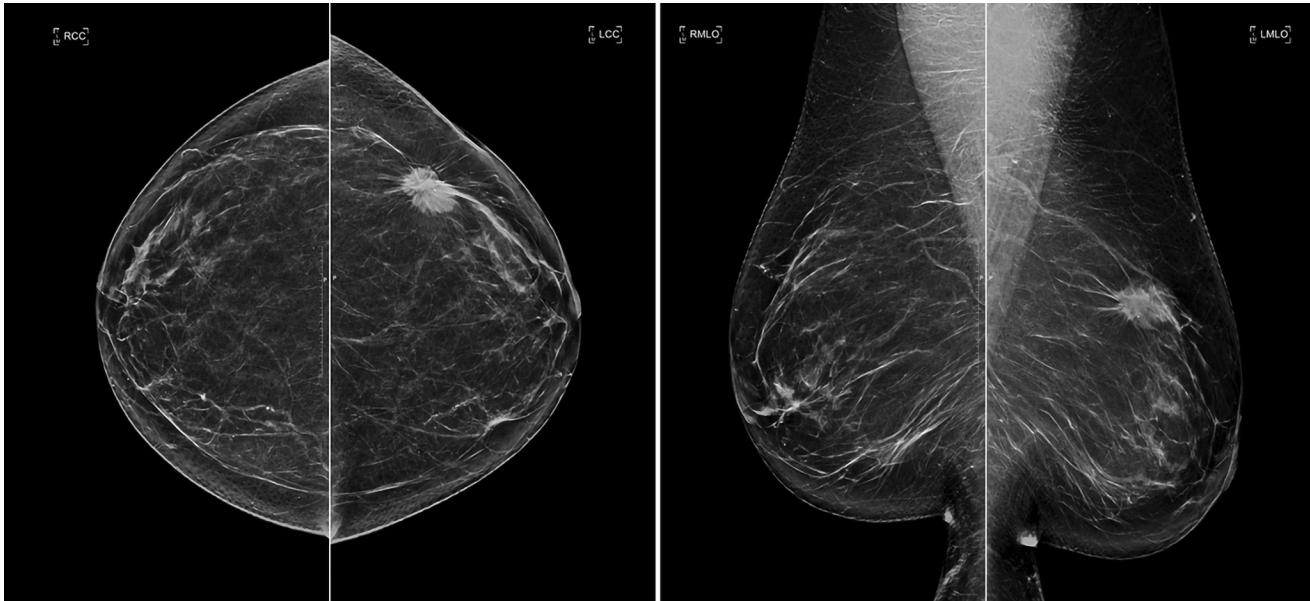
Suggested Readings

- D'Orsi CJ, Sickles EA, Mendelson EB, et al. ACR BI-RADS® Atlas, Breast Imaging Reporting and Data System. Reston, VA: American College of Radiology; 2013
- Houssami N, Cho N. Screening women with a personal history of breast cancer: overview of the evidence on breast imaging surveillance. *Ultrasonography* 2018;37(4):277–287
- Rao AA, Feneis J, Lalonde C, Ojeda-Fournier H. A pictorial review of changes in the BI-RADS fifth edition. *RadioGraphics* 2016;36(3):623–639

Case 4

Diana L. Lam

Refer to the following figure and answer the questions.



4.1 A 53-year-old at average risk of developing breast cancer presents for a screening mammogram. Which is the most appropriate overall BI-RADS category for this screening mammogram?

- A. BI-RADS category 0.
- B. BI-RADS category 1.
- C. BI-RADS category 2.
- D. BI-RADS category 3.

4.2 What would be the next most appropriate step in workup?

- A. Targeted ultrasound.
- B. Core needle biopsy.
- C. Breast magnetic resonance imaging (MRI).
- D. Surgical excision.

4.3 Which of the following BI-RADS assessment category is NOT matched with the correct management recommendation?

- A. BI-RADS category 0: Incomplete. Need additional imaging or prior mammograms.
- B. BI-RADS category 1: Negative. Routine mammography screening.
- C. BI-RADS category 2: Benign. Supplemental screening.
- D. BI-RADS category 3: Probably Benign. Short-interval follow-up.
- E. BI-RADS category 4: Suspicious. Tissue diagnosis.

Answers and Explanations

4.1 Answer: A. BI-RADS category 0.

There is a mass in the upper outer quadrant of the left breast. Therefore, additional imaging is needed to evaluate the finding and this examination overall should be a BI-RADS category 0: incomplete—needs additional imaging evaluation (A). The other categories are not appropriate (B, C, D) as this is a unique finding that is not benign and is highly suspicious given its high-density and spiculated margins as seen on the screening images.

4.2 Answer: A. Targeted ultrasound.

The most appropriate next step would be a targeted ultrasound (A) to evaluate for a sonographic correlate for the mammographic mass. Given the size and appearance of the finding on mammography, it is likely that there would be a sonographic finding of a spiculated mass. A core needle biopsy (B) would subsequently need to be performed; however, it is not the most

appropriate next step in workup. A breast MRI (C) or surgical excision (D) is not yet indicated for this patient.

4.3 Answer: C. BI-RADS category 2: Benign. Supplemental screening.

Each BI-RADS assessment category is linked to a specific management plan. All of the listed categories are correct except for (C) BI-RADS category 2 in which a benign assessment (such as distortion from excisional biopsy or lumpectomy, or bilateral benign appearing masses) has the same recommendation as a negative assessment (routine mammography screening).

Suggested Reading

D'Orsi CJ, Sickles EA, Mendelson EB, et al. ACR BI-RADS® Atlas, Breast Imaging Reporting and Data System. Reston, VA: American College of Radiology; 2013

Case 5

Diana L. Lam

Refer to the following figure and answer the questions.



5.1 Two images from a screening mammogram are shown. What is the most pertinent imaging finding?

- A. Intact subpectoral saline implants.
- B. Subpectoral saline implant, with concern for rupture.
- C. Intact subpectoral silicone implants.
- D. Subpectoral silicone implants, with concern for rupture.

5.2 Which is the best BI-RADS assessment for this mammogram?

- A. BI-RADS category 0: Needs additional imaging evaluation.
- B. BI-RADS category 1: Negative, no evidence of malignancy.
- C. BI-RADS category 2: Benign, no evidence of malignancy.
- D. BI-RADS category 3: Probably benign. Recommend follow-up mammogram in 6 months.

5.3 Which BI-RADS assessment and recommendation should be rare in reporting of a diagnostic mammogram and ultrasound examination?

- A. BI-RADS category 0: Needs additional imaging evaluation.
- B. BI-RADS category 1: Negative, no evidence of malignancy.
- C. BI-RADS category 3: Probably benign.
- D. BI-RADS category 4: Findings are suspicious for malignancy.

Answers and Explanations

5.1 Answer: D. Subpectoral silicone implants, with concern for rupture.

There are bilateral subpectoral silicone implants with concern for intracapsular rupture due to a focal superior bulge on the right and evidence of extracapsular rupture with high-density silicone extruded superiorly on the left (A). Saline implants would be more transparent on mammogram and the implant valves are usually visualized (A, B).

5.2 Answer: C. BI-RADS category 2. Benign, no evidence of malignancy.

If a screening mammogram raises a question of implant rupture but is otherwise negative, the correct BI-RADS assessment would be category 2: Benign (C) and not BI-RADS category 0 as there is no concern for a breast malignancy (A). An additional sentence that recommends a breast MRI to assess implant integrity should be included in the report to help direct further clinical care. BI-RADS category 3 assessments should be issued only after diagnostic workup (D).

5.3 Answer: A. BI-RADS category 0: Needs additional imaging evaluation.

A BI-RADS category 0 assessment should be a rare circumstance in diagnostic breast imaging; however, it can be used in rare cases where the patient was unable to complete both diagnostic mammogram and ultrasound, if indicated. This assessment can also be used in the rare circumstance when an MRI for problem-solving purposes is indicated if the diagnostic imaging is equivocal. The remainder of the BI-RADS categories are typically reported after diagnostic examinations.

Suggested Reading

D'Orsi CJ, Sickles EA, Mendelson EB, et al. ACR BI-RADS® Atlas, Breast Imaging Reporting and Data System. Reston, VA: American College of Radiology; 2013