Supplemental Views for Equivocal Mammographic Findings: A Pictorial Essay

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The value of additional mammographic views to the routine craniocaudal and mediolateral oblique views is well substantiated in the literature (1–3). Frequently, screening and diagnostic mammography will demonstrate an area that raises the concern of carcinoma. The abnormality may be visualized on only one view, visualized incompletely, or represent a factitious finding created by overlapping fibrous, glandular, and fatty tissue simulating the appearance of a mass or architectural distortion. These findings warrant supplemental views to determine if they represent real abnormalities and, if so, to further localize the lesion and characterize its nature. The more commonly utilized views, such as the coned compression view, the magnification view, and the coned compression-magnification view, are routine in the review of mammographic findings. This essay describes less commonly used supplemental views that have been particularly valuable in our experience and demonstrates their utility in specific clinical situations.

BACKGROUND

Five to 15% of cancers are diagnosed within 1 year after a normal screening mammogram using craniocaudal and mediolateral oblique views. In addition, diagnostic mammography performed for symptomatic patients do not demonstrate 5–20% of cancers (2). Supplemental views result in increased mammographic sensitivity and specificity (3,4). The use of additional views allows further characterization of equivocal mammographic findings. This is a result of dissipation of pseudolesions created by overlapping structures, improved lesion analysis, and increasing accuracy and confidence in the interpretation of mammographic abnormalities. The use of additional views may result in fewer biopsies of benign lesions and in earlier detection of malignant lesions by demonstrating characteristically benign and malignant signs that may not be visible on routine views (3).

CONED-COMPRESSION VIEW

The coned-compression view provides more rigorous focal compression and disperses overlapping dense fibroglandular tissue, optimizing visualization of the breast tissue in the region of interest (1,5). Islands of fibroglandular tissue mimicking a mass or area of architectural distortion may be spread apart, revealing only normal breast tissue. In addition, displacing overlapping fibroglandular tissue allows visualization of the margins of an underlying mass (6). The morphologic characteristics can be better visualized, determining the level of suspicion and the need for biopsy. Coned compression may result in visualization of the fatty hillus of a lymph node, allowing a probably benign circumscribed mass to be characterized as benign (7). Alternatively, the indistinct or spiculated margins of an indeterminate mass may be more clearly visualized, particularly using spot compression magnification views charac-

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The Breast Journal, Volume 6, Number 1, 2000 34–43

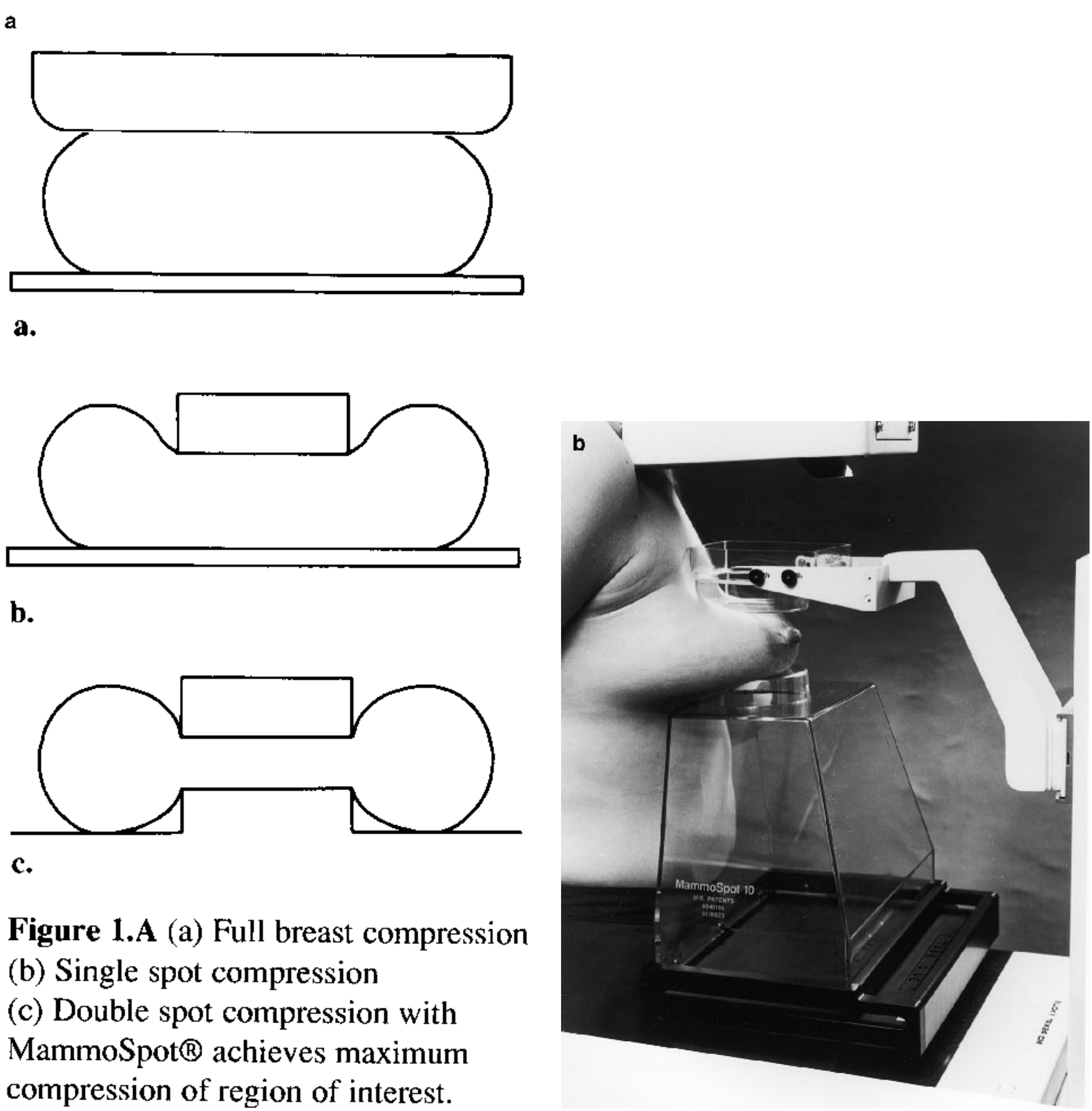

Figure 1. Double spot. (a) Schematic representation of double spot compression; (b) photograph of MammoSpot® (American Mammographics, Inc., Chattanooga, TN) compression cone. This is shown with elevation of the compression platform for magnification, but is also available without magnification.

terizing the mass as highly suspicious for malignancy. Additional benefits of the coned-compression view include the smaller field of view, which reduces scatter and results in increased contrast. Compression of breast tissue brings an area of interest closer to the film, reducing geometric distortion. Motion artifact resulting in blurring is diminished by greater immobilization of that portion of the breast (4,6). One method we use to improve compression for lesion analysis is to utilize the MammoSpot (American Mammographics Inc., Chattanooga, TN). This device achieves double compression from both above and below the lesion. We have found this particularly useful for lesions close to the bucky where spot compression from above may not achieve sufficient compression due to

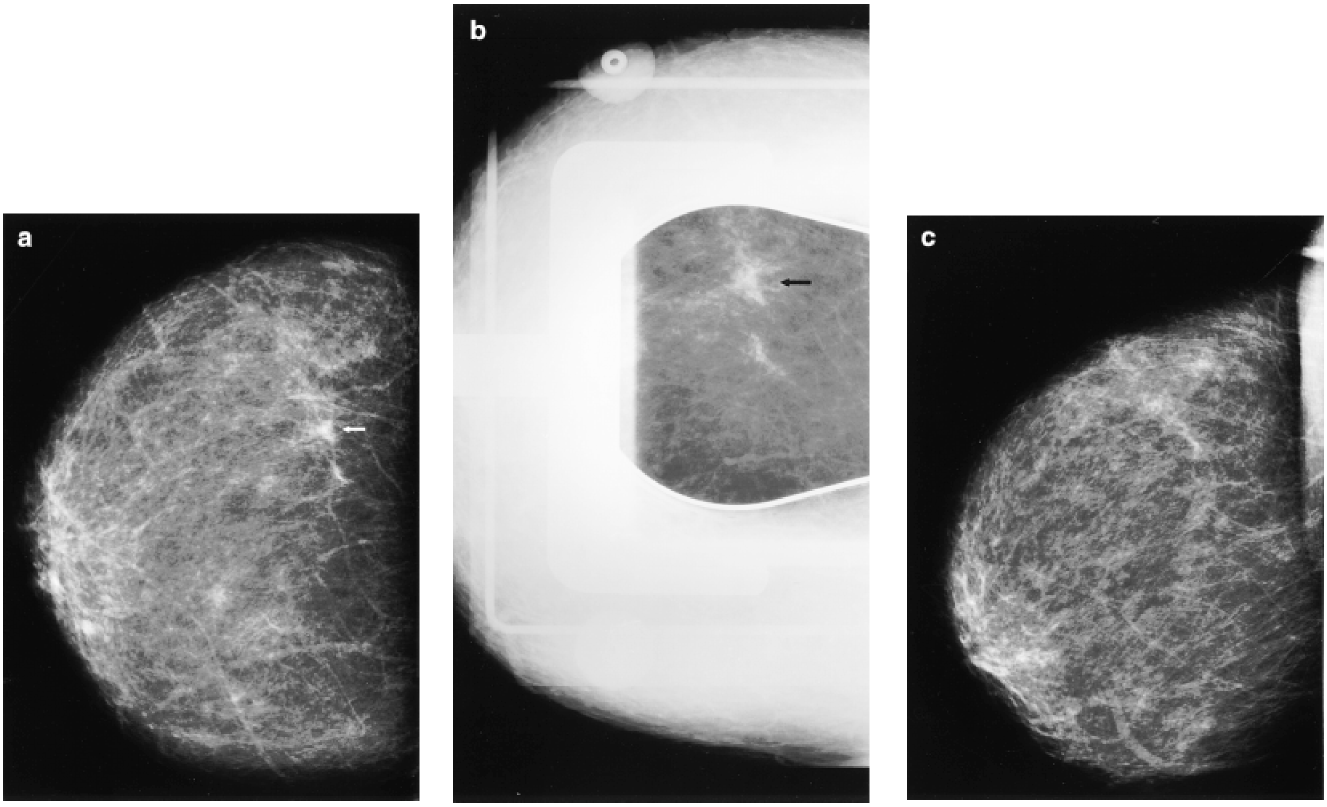

Figure 2. Angled craniocaudal view. (a) A focal radiodensity (arrow) in the posterior third of the outer breast is visualized on the craniocaudal view. (b) This focal radiodensity (arrow) persisted on the coned-compression view. (c) This area dissipated on 30° lateromedial angled craniocaudal view compatible with normal fibroglandular tissue.

the distance from the spot compression paddle to the lesion (Figure 1).

MAGNIFICATION VIEW

Magnification views, particularly spot compression magnification views, improve spatial resolution (1) and reduce scatter and noise. A magnification view is performed by decreasing the focal spot size from the 0.3 mm used for standard views to 0.1 mm. By positioning the breast on a platform that raises it closer to the focal spot and further from the film, an air gap is created which absorbs scatter radiation and therefore a grid is not used. The utility of a magnification view includes enhanced characterization of the morphology, distribution, and number of microcalcifications and the margins of masses (1).

ANGLED CRANIOCAUDAL VIEW

The craniocaudal view is performed with the X-ray beam directed 90° to the breast held in compression from above with the detector system below the breast. Superimposition of breast tissue may cause summation of shadows, creating a pseudolesion visualized as a masslike area, or may obscure a true lesion. Angling the X-ray tube medially or laterally results in separation of overlapping fibroglandular tissue. This allows the distinction to be made between normal breast tissue and a true mass. An area of focal density may be visualized as separate islands of fibroglandular tissue (Figure 2). Alternatively, a true lesion will project over fatty tissue allowing clear visualization of the margin characteristics (8). In addition, a lesion visualized on only the mediolateral oblique view may be better localized on the orthogonal craniocaudal view. By angling away from overlying breast tissue, an obscured lesion may be visualized (Figure 3).

ROLLED CRANIOCAUDAL VIEWS

The most commonly used rolled view is the craniocaudal view. This view is performed in the craniocaudal position, rolling the breast tissue medially or laterally around the axis of the nipple prior to applying compression. The rolled view can aid in determining if a lesion is real. Benign superimposed breast tissue may

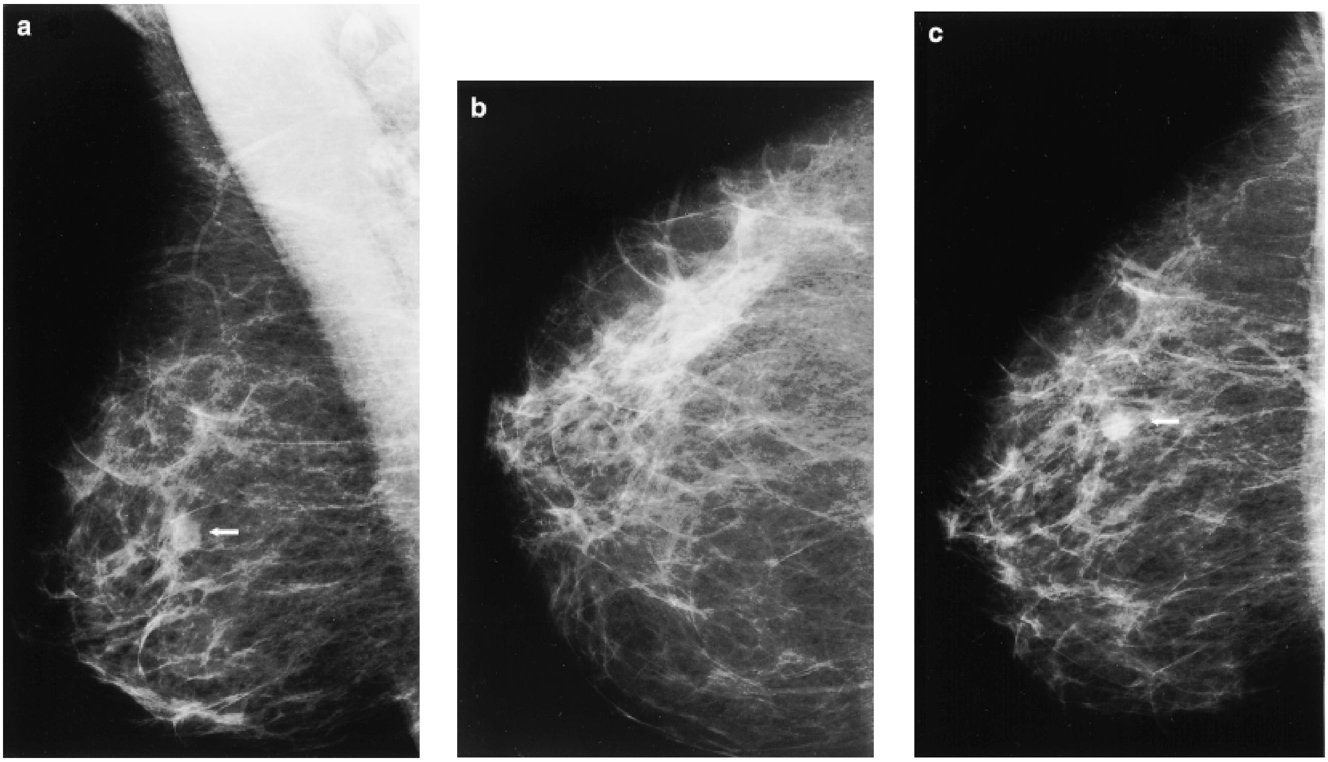

Figure 3. Angled craniocaudal view. (a) A nodule (arrow) is visualized in the central portion of the breast on the mediolateral oblique view. (b) This nodule is not seen on the craniocaudal view. (c) The 35° lateromedial angled craniocaudal view results in visualization of the nodule (arrow) by separating it from the superimposed breast tissue.

simulate a lesion. Reorienting the breast tissue separates overlapping fibroglandular tissue, dispersing the area of concern (1) (Figure 4). Alternatively, an obscured mass may be better visualized by moving breast tissue obscuring the lesion. This view can also be used to localize a lesion visualized only on the craniocaudal view. Similar to the use of parallax to localize a lesion by shifting position from mediolateral oblique to the true lateral view, a lesion can be localized by its change in position from a craniocaudal to a rolled craniocaudal view. In addition to the mediolateral or lateromedial roll, anterior tissue may be rolled posteriorly to disperse an area of concern (Figure 5). Rolled views can be done in lateral and mediolateral oblique projection using up and down roll, or anterior to posterior rolled views.

DOWNWARD AND UPWARD TUCK CRANIOCAUDAL VIEWS

This is a useful maneuver to depict lesions deep in the posterior portion of the breast. In the craniocaudal view, as compression is brought down from above, the posterior tissue may be excluded from the field of view. This is due to the normal attachments of the breast to the chest wall limiting mobility of the breast tissue. The tuck views were designed to visualize lesions deep in the posterior breast between 10 and 2 o'clock in the upper breast, and 5 and 7 o'clock in the lower (Figure 6). In the downward tuck view, the superior breast tissue is pulled forward, and the nipple and breast are rolled and tucked downward and tucked posteriorly, ignoring the inferior portion of the breast. This permits visualization of the more posterior tissue in the upper portion of the breast (Figure 7). In the upward tuck view, the inferior breast tissue is pulled forward and the breast is rolled upward and tucked posteriorly, ignoring the superior breast tissue. This allows for visualization of the more posterior, inferior breast tissue (Figure 8).

BULLSEYE VIEW

The bullseye view was designed for better evaluation of lesions in the retroareolar region. In the bullseye view, the nipple and areolar complex are di-

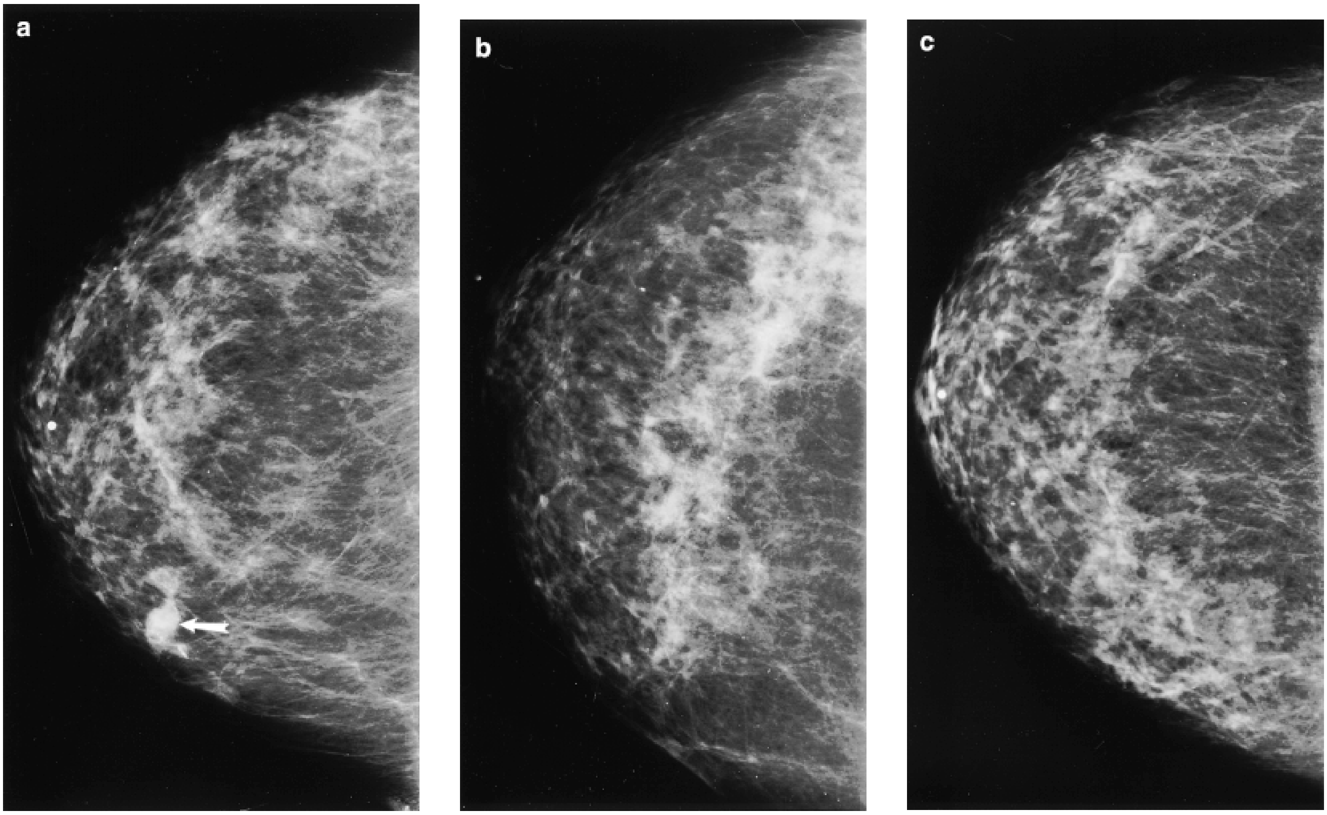

Figure 4. Rolled craniocaudal view. (a) A suspicious radiodensity (arrow) is visualized in the inner breast on the craniocaudal view. (b) On rolled craniocaudal view this area clearly resolves, compatible with normal fibroglandular tissue. (C) Craniocaudal mammogram of the same patient 6 months after the above mammogram, which confirms the presence of benign fibroglandular tissue and no evidence of a mass.

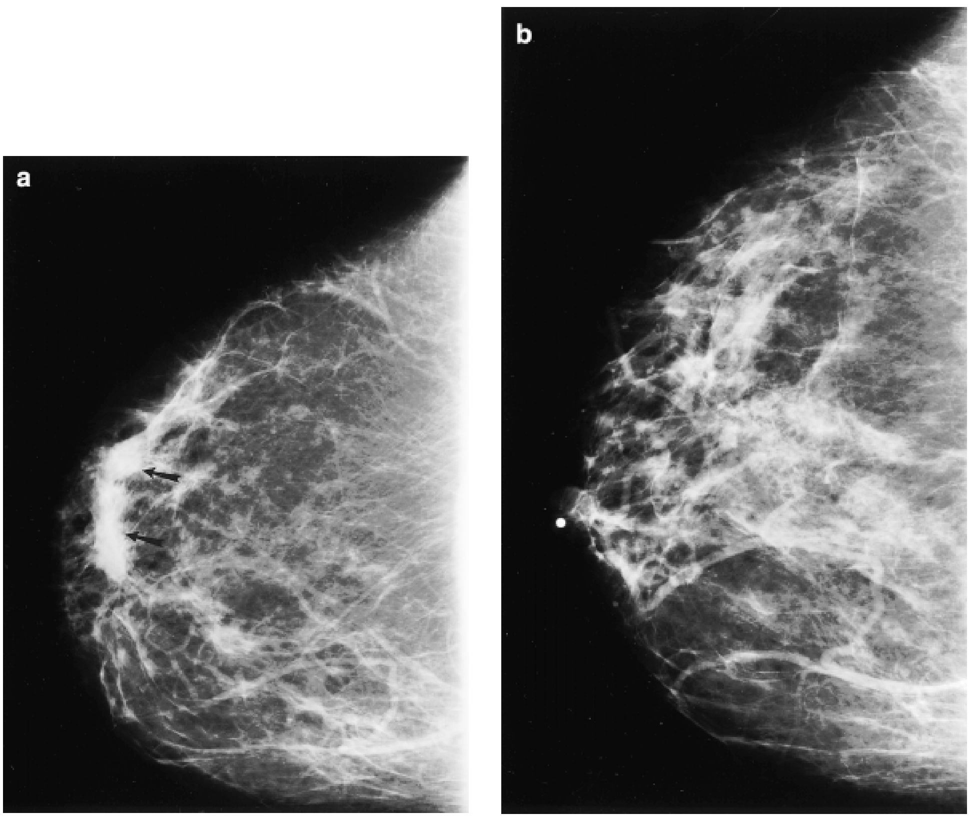

Figure 5. Anterior to posterior rolled craniocaudal view. (a) A focal band of increased radiodensity (arrows) is visualized in the anterior breast on the craniocaudal view. (b) The anterior breast tissue was rolled posteriorly, the breast was recompressed, and the craniocaudal view was repeated, demonstrating normal fibroglandular tissue without underlying mass.

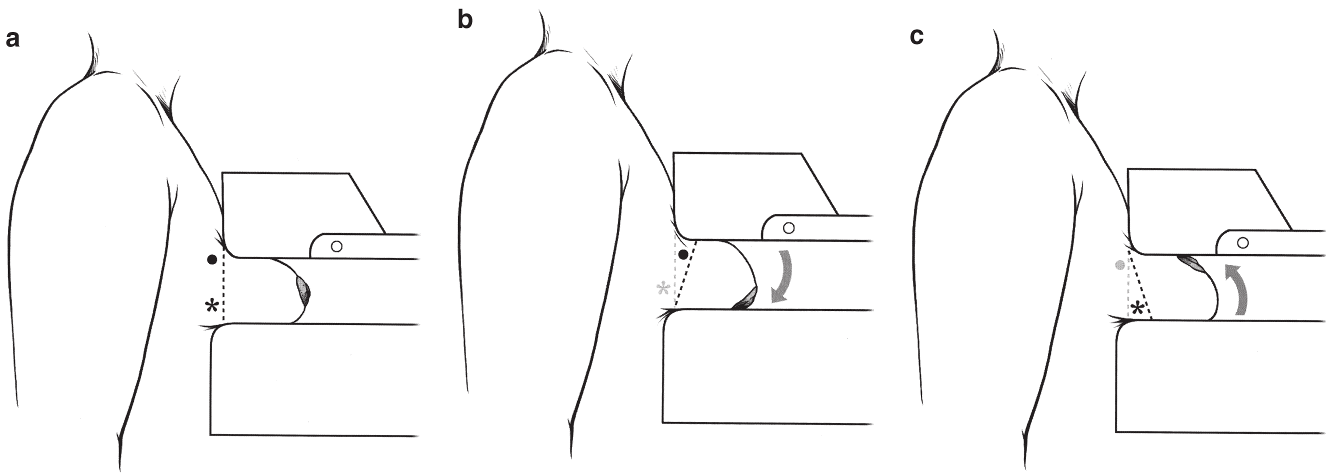

Figure 6. Schematic drawing of the craniocaudal tuck views. (a) Lesions in the posterior portion of the superior or inferior breast may not be included due to tissue cutoff on the craniocaudal view. (b) The "downward tuck" craniocaudal view rolls superior tissue anteriorly while rolling inferior tissue posteriorly, bringing the superior lesion (bullet) forward into the imaging field. (c) The "upward tuck" craniocaudal view rolls inferior tissue anteriorly while rolling superior tissue posteriorly, bringing the inferior lesion (asterisks) forward into the imaging field.

rected superiorly or inferiorly in the mammography unit and routine or spot compression is applied. In this position, the nipple areolar and periareolar region are visualized en face. This view allows better visualization and characterization of lesions in this region (Figures 9 and 10).

CLEOPATRA VIEW

The Cleopatra view was originally described as a technique to visualize the far-lateral breast tissue and axillary tail, similar to the exaggerated craniocaudal view. For the Cleopatra view, the patient is in a semireclining position, oblique toward the side of interest (9). This view was found to be useful for xeromammography in which the overhead tube did not have the angling capabilities of today's dedicated mammographic units (5). The Cleopatra view is geometrically similar to the mediolateral oblique view, however, the patient, instead of the X-ray tube, is obliqued (Figure 11). This view is no longer necessary since the X-ray tube and film holder can be angled while the patient remains upright. This achieves a comparable effect, while maintaining patient comfort. If the mediolateral oblique view provides an insufficient view of the breast tissue in the axilla, an axillary tail view may be performed. The c-arm is angled less than the 45°–55° typically used for the mediolateral oblique view, resulting in positioning parallel to the axillary tail (1).

ADDITIONAL SUPPLEMENTAL VIEWS

This article is intended to illustrate some of the less commonly used additional views and clinical situations which we have found them useful. The reader should be aware that a number of other supplemental views are also very useful. These include the 90° lateral view, exaggerated craniocaudal view, cleavage view, tangential views, and special views for the augmented breast. The reader is referred to the American College of Radiology mammography quality control manual (1) for an in depth review of these additional views.

CONCLUSION

Further evaluation of equivocal mammographic findings with the use of supplemental views, alone or in combination, results in many lesions being better defined as more likely benign or malignant. In addition, pseudolesions, which may initially appear concerning, can be shown to be due to overlapping normal structures. Therefore the number of short-term follow-up examinations and/or biopsies may be reduced and occult malignancies may be diagnosed earlier. This article has reviewed some of the supplemental views that are commonly used and introduced new views, the craniocaudal/caudocranial tuck views and the bullseye view, and has reviewed the clinical situations in which we find them valuable.

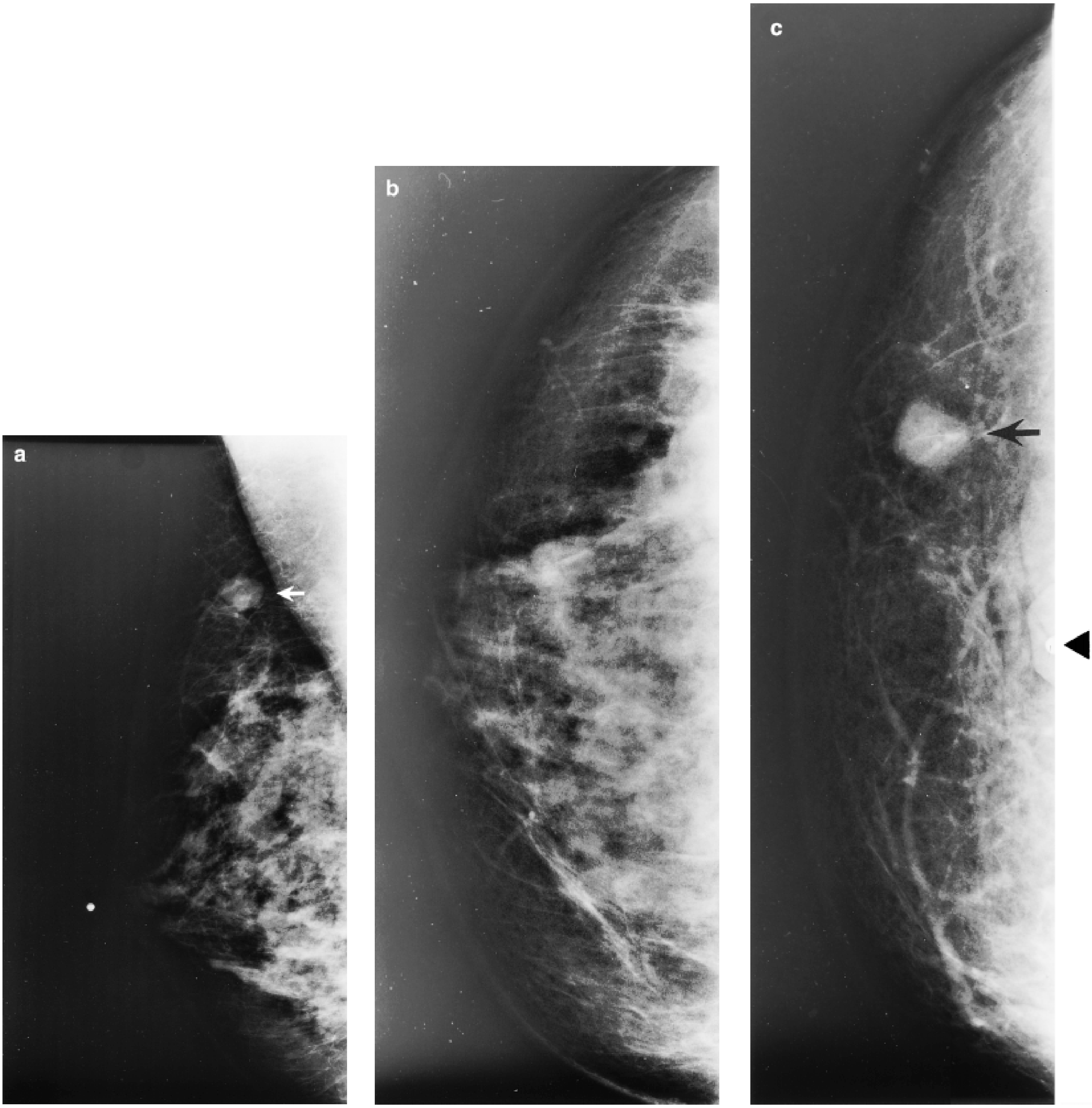

Figure 7. Downward tuck view. (a) A mass (arrow) in the upper breast is seen only on the mediolateral oblique view. (b) The mass is not visualized on the craniocaudal view. (c) Downward craniocaudal tuck view demonstrates the mass (arrow) to be in the posterior outer portion of the breast. The nipple and nipple-marker (arrowhead), having been tucked downward for this view, are visualized en face. The tuck view allows for increased visualization of posterior breast tissue.

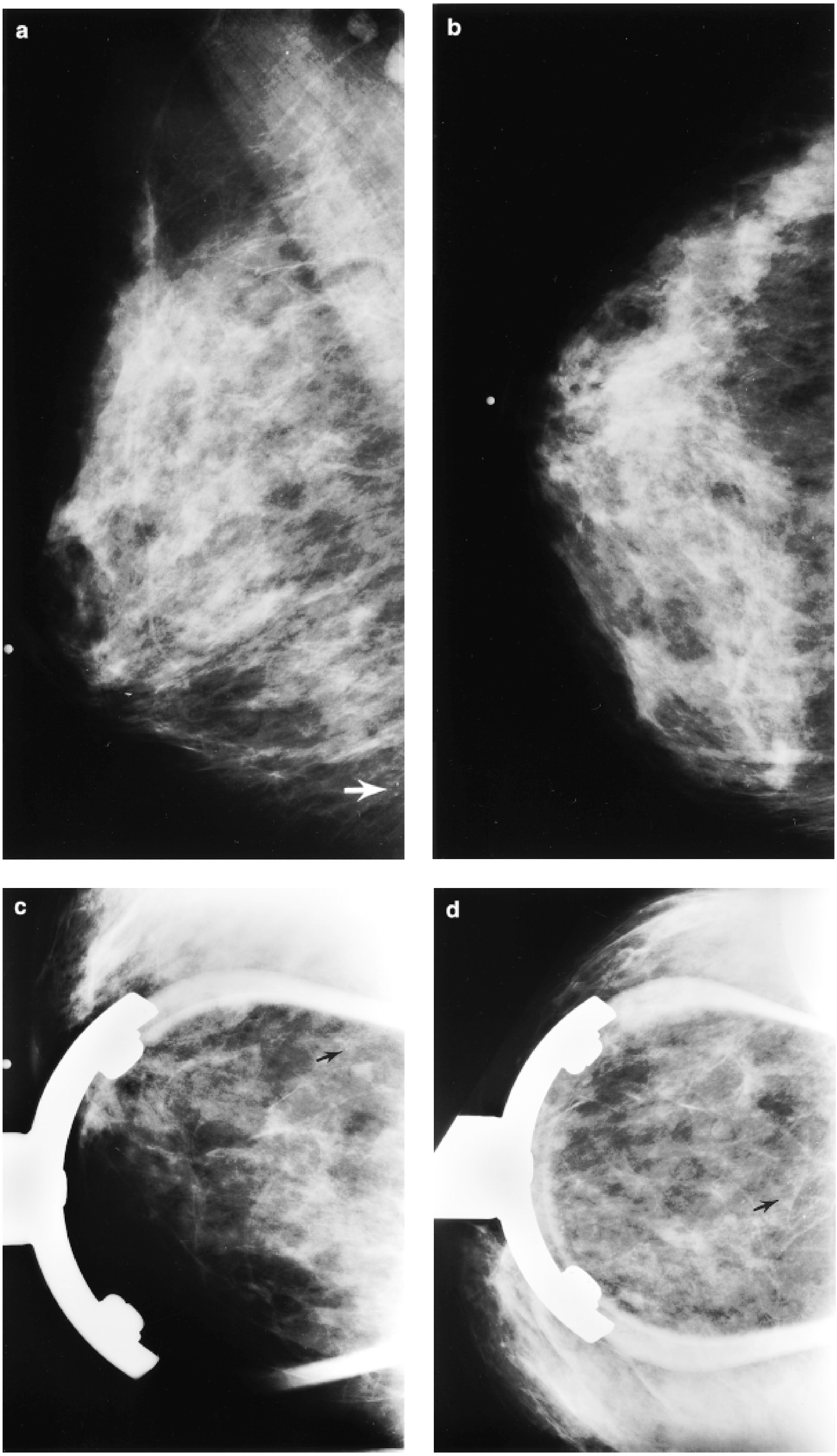

Figure 8. Upward tuck view. (a) Microcalcifications (arrow) in the posterior lower breast are seen on the mediolateral oblique view only. (b) The microcalcifications are not visualized on the craniocaudal view. (c) Routine spot compression magnification view shows only the anterior portion of the grouping of microcalcifications (arrow). (d) The upward tuck spot magnification view shows pleomorphic microcalcifications (arrow) to be in the central posterior portion of the breast.

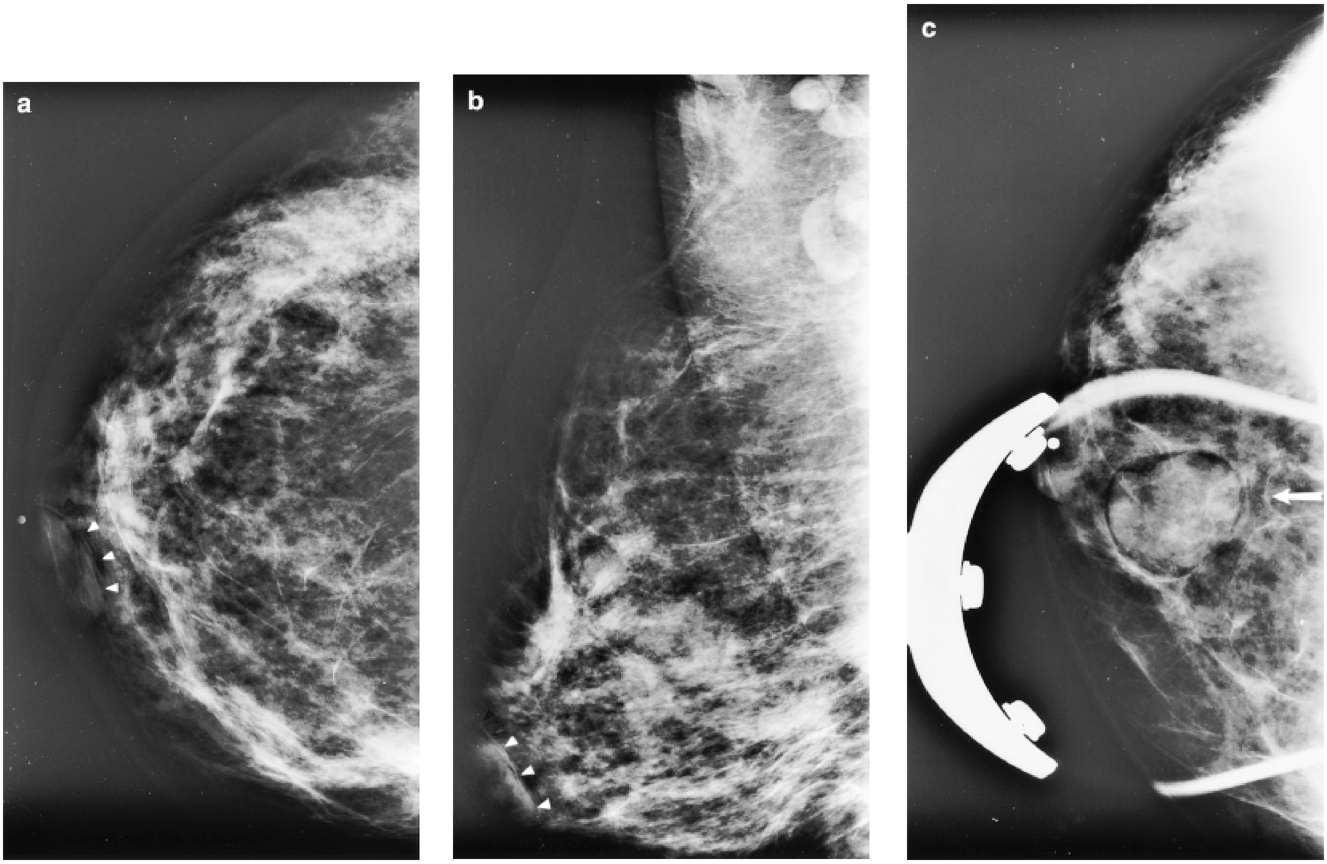

Figure 9. Bullseye view. (a) Screening mammogram shows a nonspecific soft tissue density (arrowheads) in the medial retroareolar breast noted on the craniocaudal view. (b) This soft tissue (arrowheads) is visualized in the central retroareolar region on the mediolateral oblique view. (c) The spot compression bullseye view allows for clear demonstration of a 2.8 cm × 2.4 cm mass containing soft tissue and fat compatible with a fibroadenolipoma (arrow).

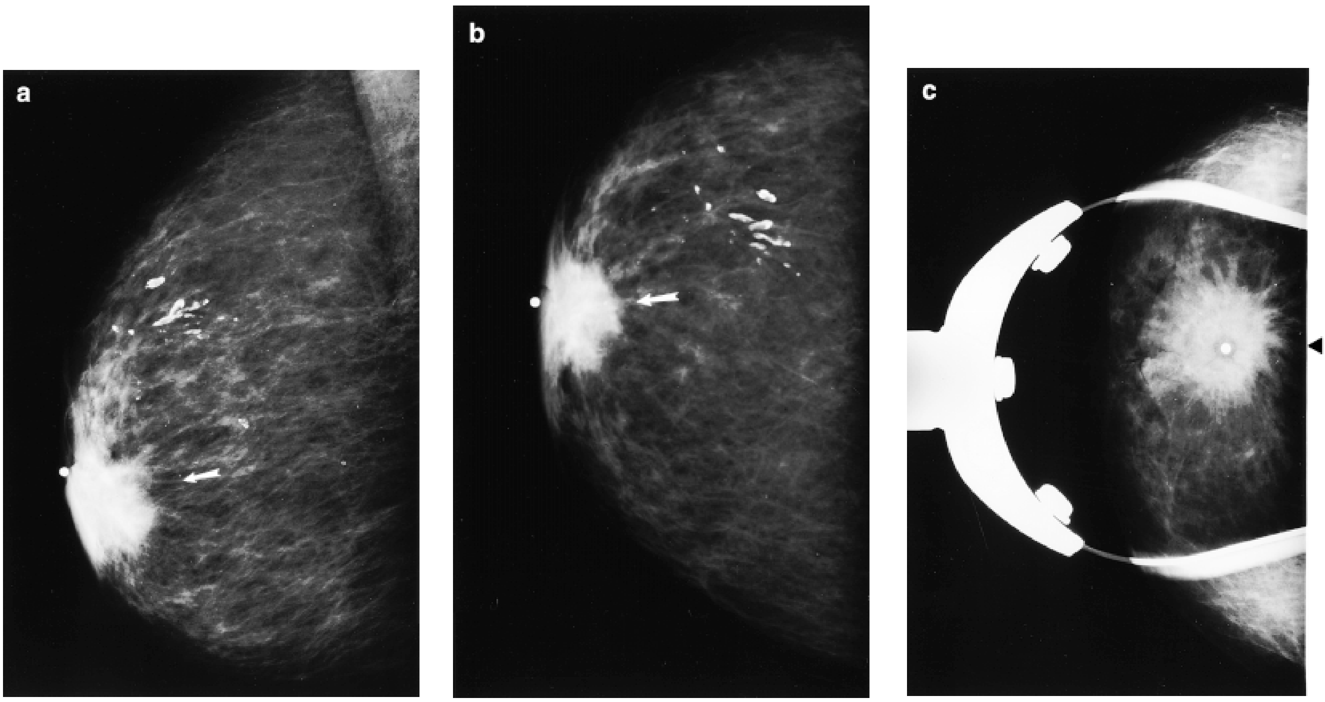

Figure 10. Bullseye view. (a) Mediolateral oblique view of a patient 1 month postexcision of a retroareolar mass shows postoperative edema and tissue reaction (arrow) of uncertain extent. (b) Similar findings are seen on the craniocaudal view (arrow). (c) Spot compression bullseye view clearly depicts the complete retroareolar extent and distribution of the parenchymal changes (arrowhead).

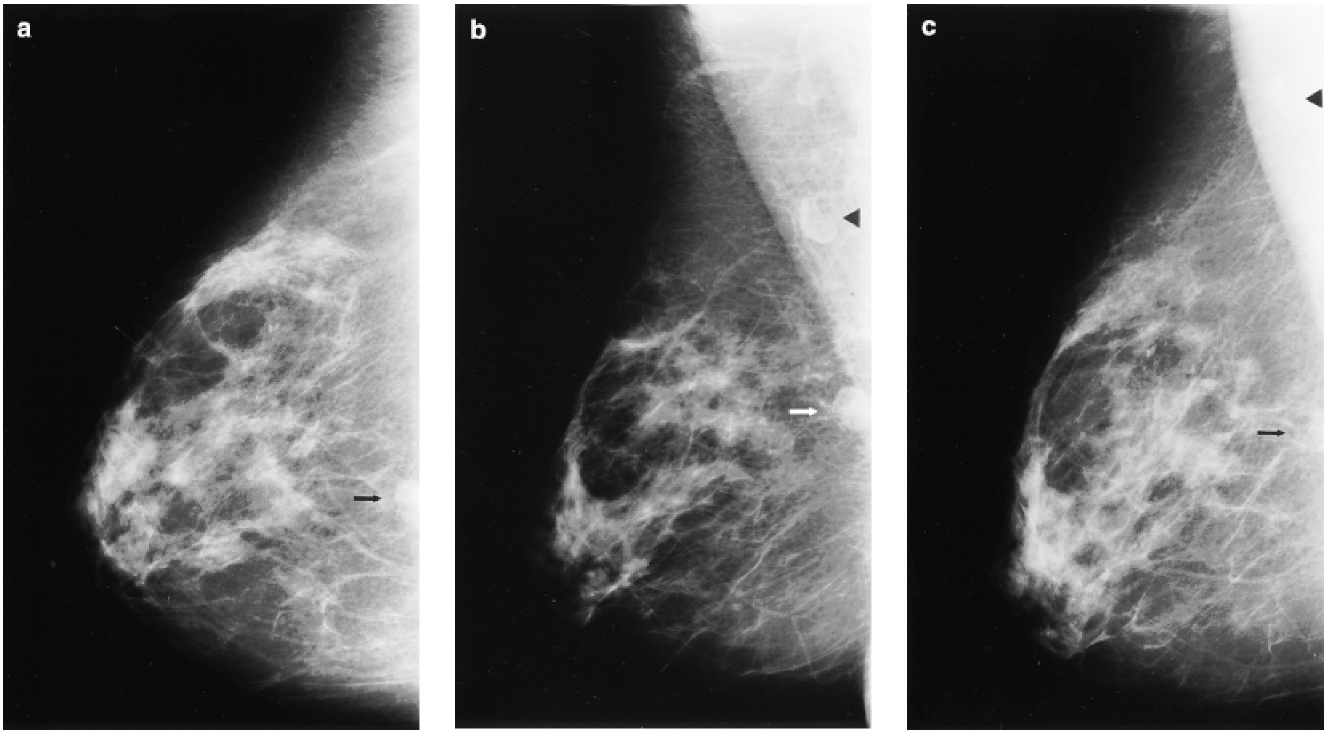

Figure 11. Cleopatra view. The Cleopatra view is anatomically equivalent to the mediolateral oblique view; however, the patient instead of the X-ray tube is obliqued. (a) Craniocaudal view shows a nodule (arrow) deep in the posterior central breast. (b) Mediolateral oblique view demonstrates the nodule (arrow) to be located in the deep posterior upper breast. An axillary lymph node overlies the inferior pectoralis muscle (arrowhead). (c) In the Cleopatra view the nodule (arrow) maintains an almost identical relationship to the axillary lymph node (arrowhead) and inferior margin of pectoralis muscle as in the mediolateral oblique view.

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