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Avoiding Pitfalls in Mammographic Interpretation

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Abstract

There is a public misconception that screening mammography detects all breast malignancies. The objective of this pictorial essay is to review classic mammographic features of malignancy that, if missed, could potentially result in malpractice litigation. By identifying radiologic themes, we attempt to improve awareness about the imaging characteristics of a variety of subtle malignancies.

Résumé

Il existe une idée fausse répandue dans la population voulant que la mammographie de dépistage permette de déceler tous les types de tumeurs malignes aux seins. Cet article descriptif a pour but de passer en revue les caractéristiques classiques des tumeurs malignes à la mammographie qui, si elles ne sont pas détectées, peuvent mener à un litige pour faute professionnelle. En définissant des thèmes liés à la radiologie, nous tentons d'améliorer la connaissance des caractéristiques d'un éventail de tumeurs malignes subtiles visibles par imagerie. © 2011 Canadian Association of Radiologists. All rights reserved.

Key Words: Breast; Breast cancer; Mammography; Malpractice

Introduction

Mammography is the standard screening tool for detection of breast cancer, yet 10%−30% of cancers may be missed with mammography [1]. Education of the general public regarding the limitations of mammography is lacking, and many malpractice cases arise because of the misconception that mammography detects all malignancies and that any delay in diagnosis leads to a worse outcome [2]. Delay in diagnosis of breast cancer remains a leading cause of malpractice, particularly for radiologists who practice breast imaging [3].

From the imaging perspective, breast cancers may be missed because of failure to perceive an abnormality, incorrect interpretation of an abnormality, lesions obscured by dense parenchyma, or lesions missed because of poor positioning or technique [1,4]. Many of the imaging findings in these types of cases are subtle and likely do not relate to actual negligence on the part of the interpreting radiologist.

However, these types of cases are difficult to defend in a court of law, because juries often side with the plaintiff.

In this article, we review some common pitfalls in breast imaging, which, if overlooked or misinterpreted, might lead to an unnecessary delay in diagnosis. The topics discussed below include: (1) edge of film findings; (2) suspicious, but stable morphology; (3) slowly developing asymmetry; (4) architectural distortion; (5) benign-appearing nodule; (6) presumed intramammary lymph node; (7) shrinking breast; and (8) scar carcinoma. By identifying radiologic themes, we aim to increase awareness of these subtle imaging presentations in hopes of earlier detection and improved outcomes.

Edge of Film Findings

Edge of film findings refer to any finding visualized at the margin of an image. As seen in Figure 1, there is a subtle mammographic asymmetry only seen on the edge of the craniocaudal (CC) view (Figure 1). Another subtle malignancy, only seen on 1 of the conventional images, which could be easily overlooked, is demonstrated in Figure 2. In reality, even if a finding is only seen on the edge of a single view, additional imaging is necessary to confirm

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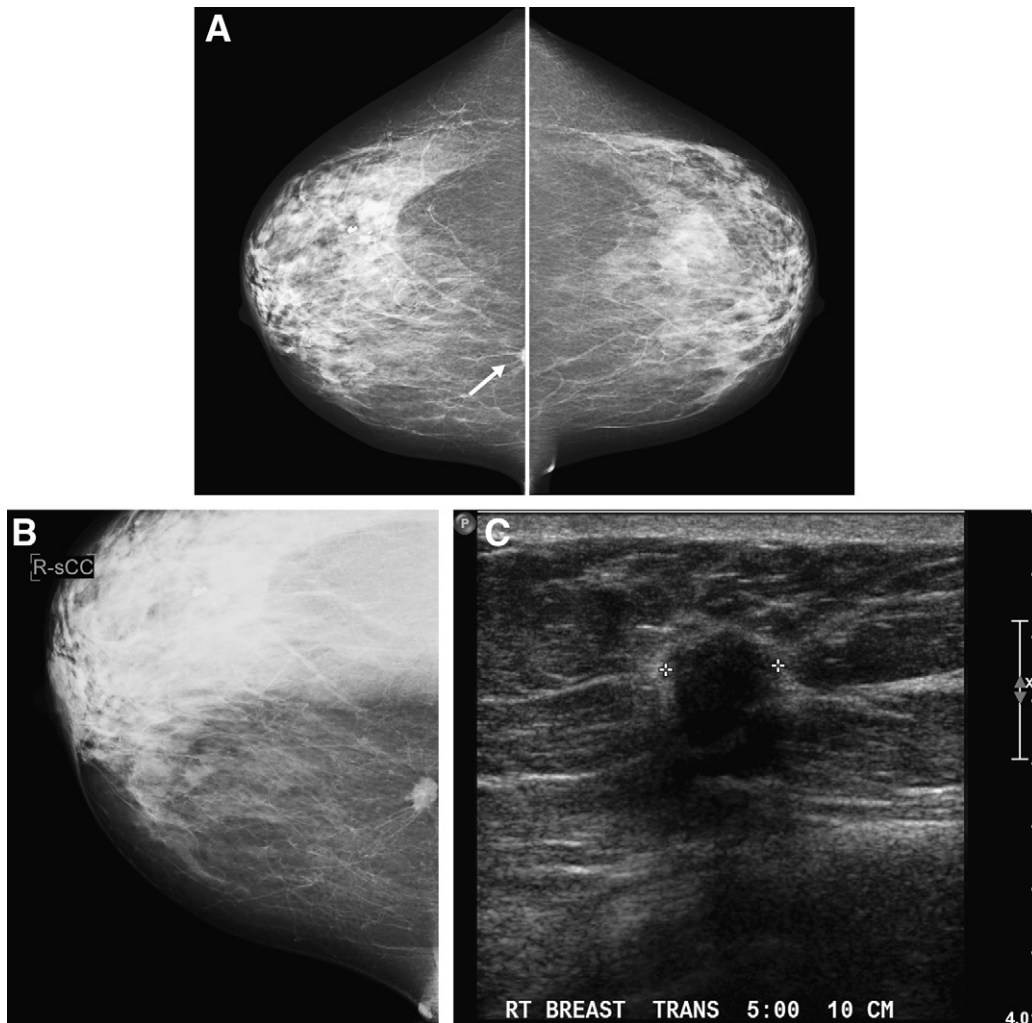*E-mail address:* pslanetz@bidmc.harvard.edu (P. J. Slanetz).

Figure 1. Screening mammogram in a 60-year-old woman who is postmenopausal. (A) Craniocaudal (CC) view of a screening mammogram, showing a subtle edge of film asymmetry in the medial right breast (arrow), not included on the mediolateral oblique view (not shown). (B) Spot compression CC view confirms a spiculated mass in the posteromedial breast. (C) Sagittal view on ultrasound reveals an irregular hypoechoic mass suspicious for malignancy. Histopathologic analysis revealed grade II invasive ductal carcinoma.

whether the finding represents a true mass, and if so, biopsy may be warranted. It is also important to adhere to strict positioning standards to maximize the amount of tissue that is imaged [1].

Suspicious but Stable Morphology

Breast cancer may grow slowly and, in the absence of substantial growth over time, can lead to the false impression that a lesion is benign [5]. In practice, the morphology of a mass and distribution of calcifications should almost always take precedence over lesion stability [5]. Examples of suspicious morphology include spiculated or ill-defined margins of a mass (Figure 3) or calcifications in a linear or segmental distribution (Figure 4). Even if a suspicious mammographic abnormality has been present and stable for 2 or more years, suspicious morphology or suspicious distribution of calcifications still warrants intervention because it may represent a low-grade malignancy.

Slowly Developing Asymmetry

Leung and Sickles [6] define a developing asymmetry as a new focal asymmetric area of fibroglandular parenchyma not previously present or as one that has increased in size or conspicuity. A gradually developing abnormality on mammography (Figure 5) should be regarded with concern, because 6% of cancers manifest as a developing density on mammography [6]. To avoid missing a gradually developing abnormality, it is crucial that radiologists compare the current study with remote mammograms, because multiple prior publications have established the value of comparing current mammograms with those from previous examinations [7,8]. It also has been shown that, for diagnostic
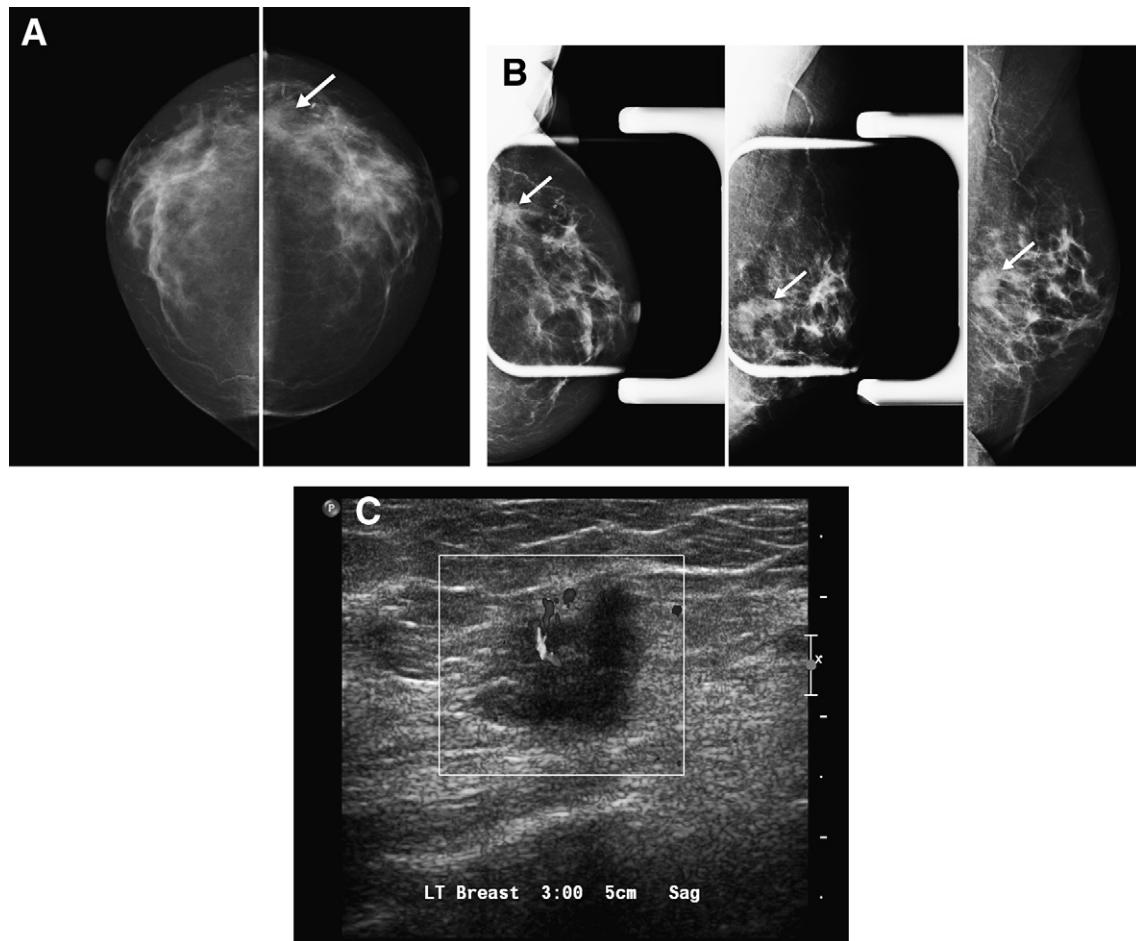
Figure 2. Screening mammogram in a 72-year-old woman. (A) Craniocaudal (CC) view from screening mammogram, showing an asymmetry in the deep lateral right breast (arrow), not included in the mediolateral oblique (MLO) view (not shown) and not visible on prior screening studies. (B) CC and MLO spot compression and mediolateral views demonstrate the mass. (C) Sagittal view on ultrasound, revealing an irregular hypoechoic solid mass, which was pathologically proven invasive ductal carcinoma, grade II, with metastatic adenocarcinoma, involving 4 of 12 lymph nodes.

mammography, comparison with prior mammograms is associated with an increase in the cancer detection rate [9]. In cases in which the mammographic evaluation is equivocal, targeted ultrasound or breast magnetic resonance imaging (MRI) can be useful to help exclude an underlying malignancy.

Architectural Distortion

Architectural distortion refers to a focal area of breast tissue that appears distorted because of radiating spiculations (Figure 6) and focal areas of retraction and tethering, without a discrete associated mass (Figure 7) [10]. Because architectural distortion may mimic the normal appearance of overlapping breast tissue, this finding can be subtle and may be difficult to detect [11]. Distortion can be associated with benign lesions, such as surgical scars, radial scars, or fat necrosis; however, the malignancy rates for architectural distortion range from almost one-half to two-thirds of the cases [10,11]. One study that evaluated the efficacy of commercially available computer-aided detection systems

(CAD) showed that CAD had a low sensitivity for the detection of architectural distortion, identifying fewer than one-half of the cases, and hence, breast imagers should remain vigilant in the assessment of distortion [11]. Although there is considerable interobserver variability with regard to architectural distortion, double reading of mammograms has been shown to increase the detection rate for breast cancer up to 15% and may help improve detection of this subtle finding [1]. Therefore, having a low threshold to recall patients for additional imaging evaluation of distortion is critical. Even on the diagnostic workup, it is important to carefully evaluate this type of finding. If the tissue is at all fibroglandular, even if it appears to dissipate on spot mammographic views, then ultrasound or MRI can aid in excluding an underlying malignancy.

Benign-appearing Nodule

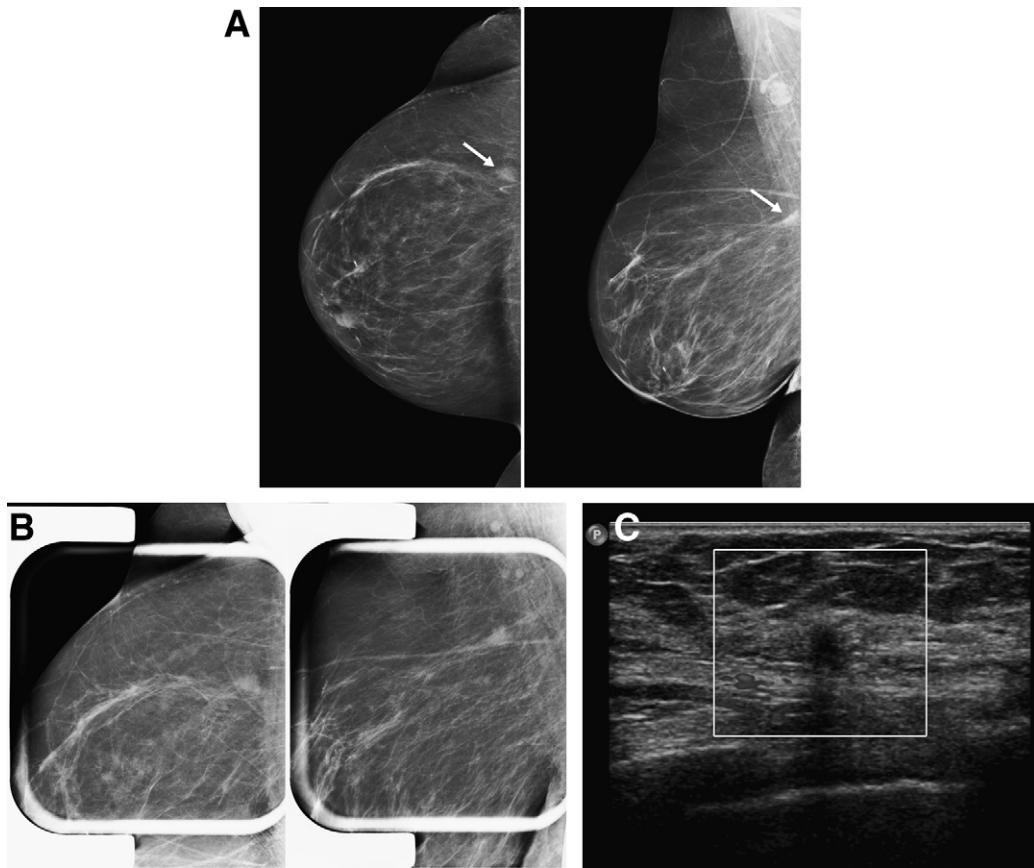It is important to remember that not all cancers have spiculated margins and an irregular shape. Some cancers

Figure 3. An 80-year-old woman for screening. (A) Right craniocaudal and mediolateral oblique views, showing a focal asymmetry in the deep upper outer breast (arrow), which was stable for 10 years and classified as glandular asymmetry by the interpreting radiologist. (B) Spot compression images demonstrating the mass to better advantage. (C) Sagittal view on ultrasound confirms a hypoechoic irregular mass at 10-o'clock position, 9 cm from the nipple, which was pathologically proven invasive carcinoma, predominantly mucinous type.
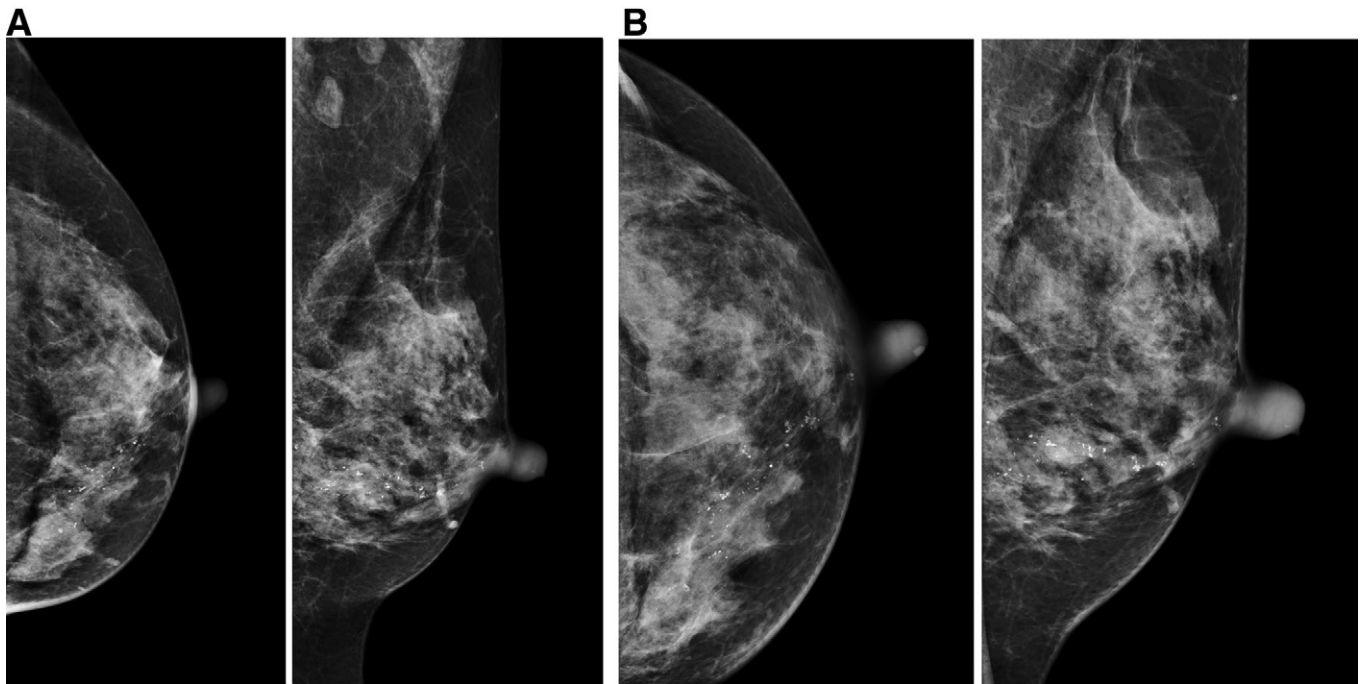

Figure 4. A 56-year-old woman who presented for a 6-month follow-up of calcifications in the left breast. (A) Craniocaudal (CC) and mediolateral oblique (MLO) views from left diagnostic mammogram and (B) left spot magnification CC and MLO views, demonstrating calcifications in a segmental distribution in the lower medial left breast. Although these calcifications appear coarse and many have lucent centres that suggest a benign etiology, the distribution was suspicious, and biopsy revealed ductal carcinoma in situ, intermediate-to-high nuclear grade.
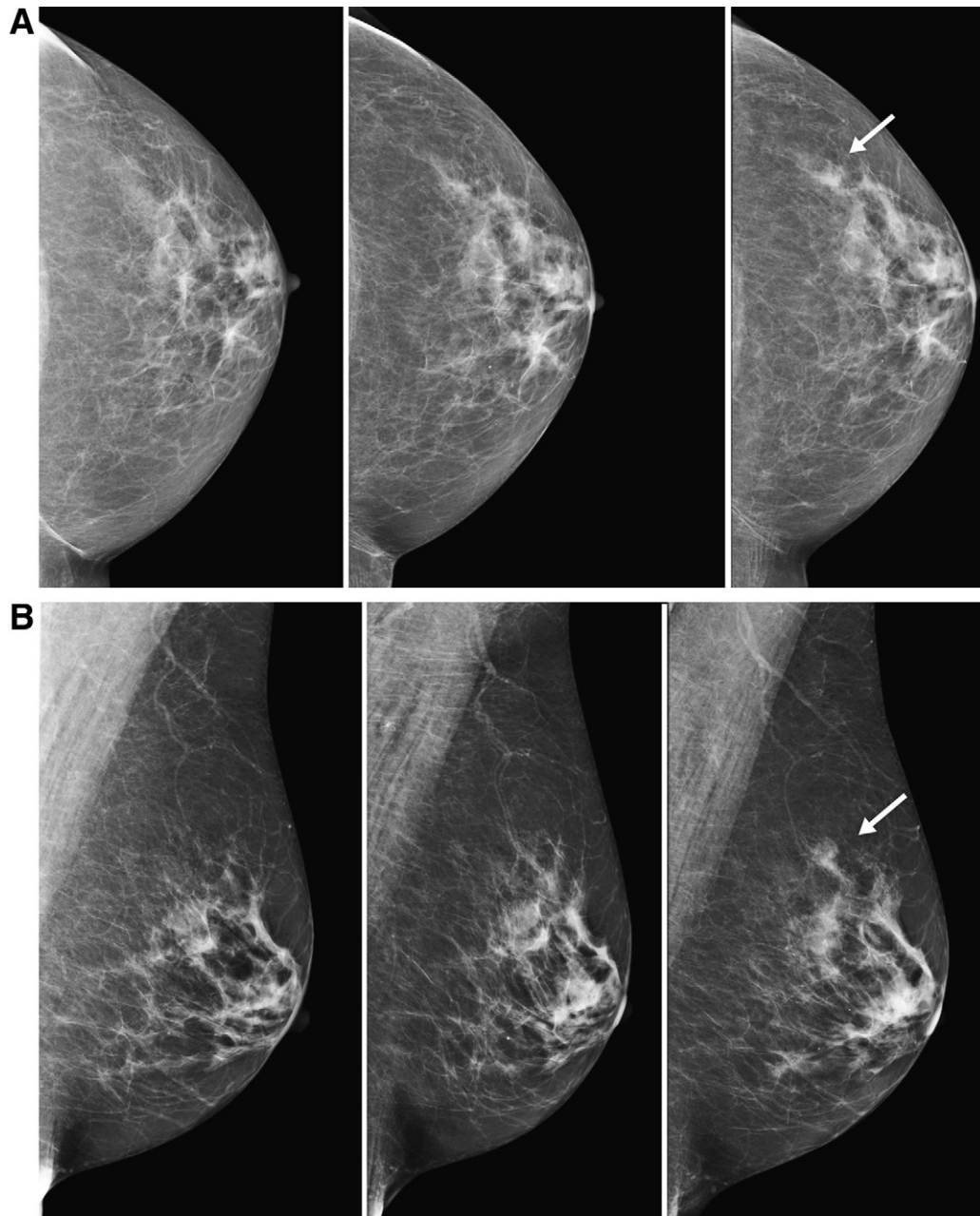
Figure 5. A 67-year-old woman for screening. (A) Craniocaudal and (B) mediolateral oblique views from left consecutive annual mammograms over 3 years, showing a slowly developing asymmetry in the upper outer quadrant (arrow), which was pathologically proven grade I invasive ductal carcinoma.

present as relatively well-circumscribed masses on screening mammography, particularly medullary, mucinous, and papillary subtypes [4]. However, on spot compression, these "circumscribed" cancers usually have ill-defined margins (Figure 8) [12]. Therefore, it is important to be wary of a new mass that appears to be circumscribed at first glance. Although many of these will be benign lesions, such as cysts or fibroadenomas, it is necessary to image the patient with additional mammographic views and ultrasound to better characterize the finding. Ultrasound is particularly helpful in predicting the likelihood of a malignancy of a circumscribed

mass, and it is important to correlate the sonographic findings with those on mammography [4].

Presumed Intramammary Lymph Node

Benign-appearing intramammary lymph nodes are generally found in the upper outer quadrant and typically are less than 1 cm in diameter, well-circumscribed, oval or lobulated masses with radiolucent fatty hilum visible on mammography [13,14]. On ultrasound, a benign-appearing intramammary lymph node should have
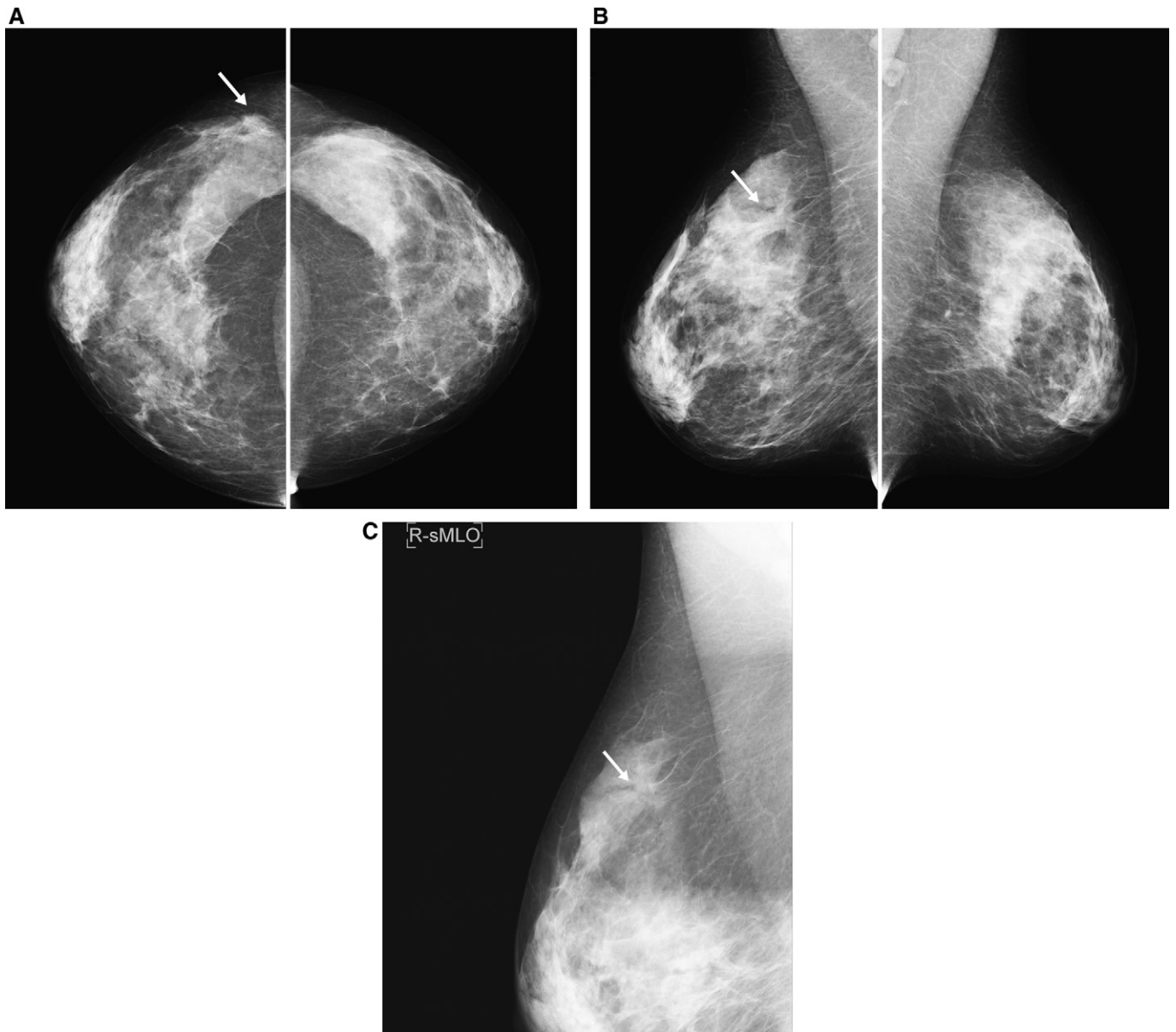
Figure 6. A 61-year-old woman for screening. (A) Craniocaudal and (B) mediolateral oblique (MLO) views from screening mammogram, showing an area of architectural distortion in the right upper outer quadrant (arrow). (C) Right diagnostic spot MLO view, showing persistent distortion (arrow), but this was not perceived by the interpreting radiologist and was thought to represent superimposed breast tissue. No ultrasound was performed at that time. The patient returned 5 months later with a palpable lump in the region of distortion. Histopathologic analysis revealed invasive ductal carcinoma with metastatic carcinoma that involved 1 of 7 lymph nodes.

smooth or lobulated margins, with a thin hypoechoic cortex and an echogenic central hilum. Any irregularity of the margins of mass should raise concern for malignancy and warrant intervention (Figure 9). Rarely, benign-appearing intramammary lymph nodes may be seen in locations other than the upper outer quadrant; however, because of the infrequency of this occurrence, additional imaging with mammography and ultrasound should be performed to confirm that the mass meets the morphologic criteria for a normal-appearing lymph node rather than a malignancy [14].

Shrinking Breast

A decrease in breast size has been described with advanced cases of infiltrating lobular carcinoma (ILC) [15]. This subtype of breast cancer is known to be difficult to diagnose on both mammography and on physical examination because it infiltrates the breast as a single layer of cells, often referred to as ''Indian-filing,'' with little disruption of the normal parenchymal architecture until it has diffusely spread through a substantial amount of breast tissue [15]. This infiltration can eventually lead to the appearance of
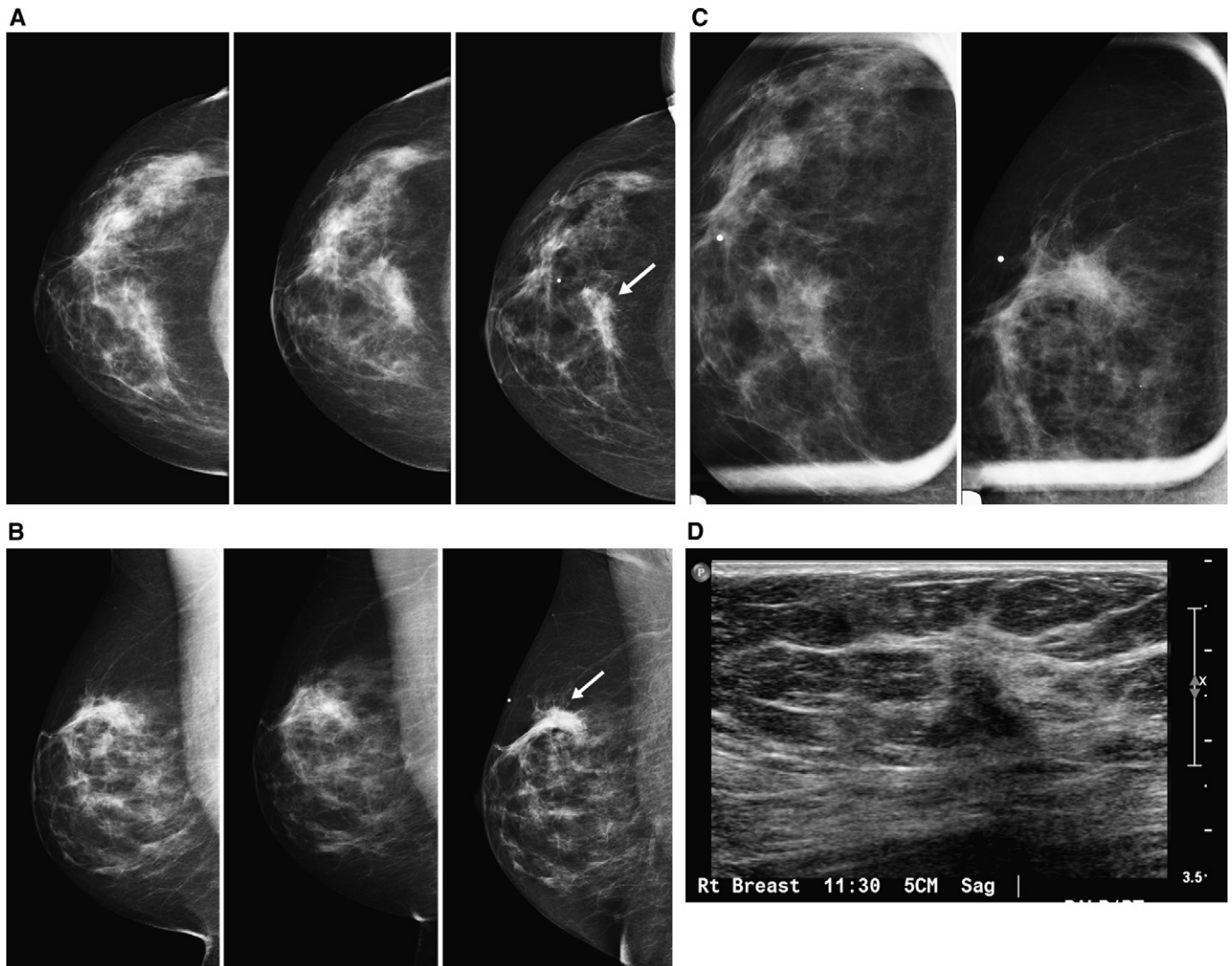
Figure 7. A 66-year-old woman who presented with a palpable lump in the right breast 10 months after a "negative" screening examination. (A) Re-review of the craniocaudal (CC) and (B) mediolateral oblique (MLO) views of the right breast on consecutive annual mammograms over 3 years, showing developing architectural distortion (arrow) in the central upper breast (area of distortion was palpable in 2009). (C) Magnified spot compression CC and MLO views, demonstrating distortion and pleomorphic calcifications that correspond to the area of concern to the patient. (D) Sagittal view on ultrasound, showing an irregular hypoechoic mass, which was pathologically proven invasive ductal carcinoma arising in extensive high-grade ductal carcinoma in situ.

distortion and retraction of the glandular tissue and trabecular thickening, eventually accompanied by loss of breast volume [16]. On imaging, this process manifests as a poorly compressible breast that becomes smaller over time because of the diffusely infiltrating tumour (Figure 10) [15,16].

Because the mammographic findings in these cases are subtle, often without a discrete mass, comparison with prior studies will aid the radiologist in recognizing cases of a diffusely infiltrative process. Focusing on the posterior and superficial interfaces of fat and glandular tissue will also help in detecting those subtle findings, because as the breast "shrinks," more fat becomes visible behind the glandular tissue and underneath the skin surface [16].

Scar Carcinoma

Breast cancer that develops from a surgical scar related to prior benign breast biopsy is rare, with only 13 cases of this type of malignancy reported in the literature to date [17]. Carcinoma that forms in the scar from a benign breast biopsy can be subtle and may present with vague developing asymmetry, suspicious microcalcifications, or fullness of the biopsy bed (Figure 11). Correlation with clinical history to exclude a superimposed acute infection or recent trauma and comparison with old studies can be helpful to identify these subtle changes. When the mammogram is indeterminate, MRI can also be used to further evaluate because suspicious enhancement in a biopsy bed would be concerning for malignancy.

Discussion

As many as 30% of breast cancers may be missed with mammography [1]. For a specific case to meet the criteria of malpractice, the interpreting radiologist must be negligent in the mammographic interpretation and the resulting
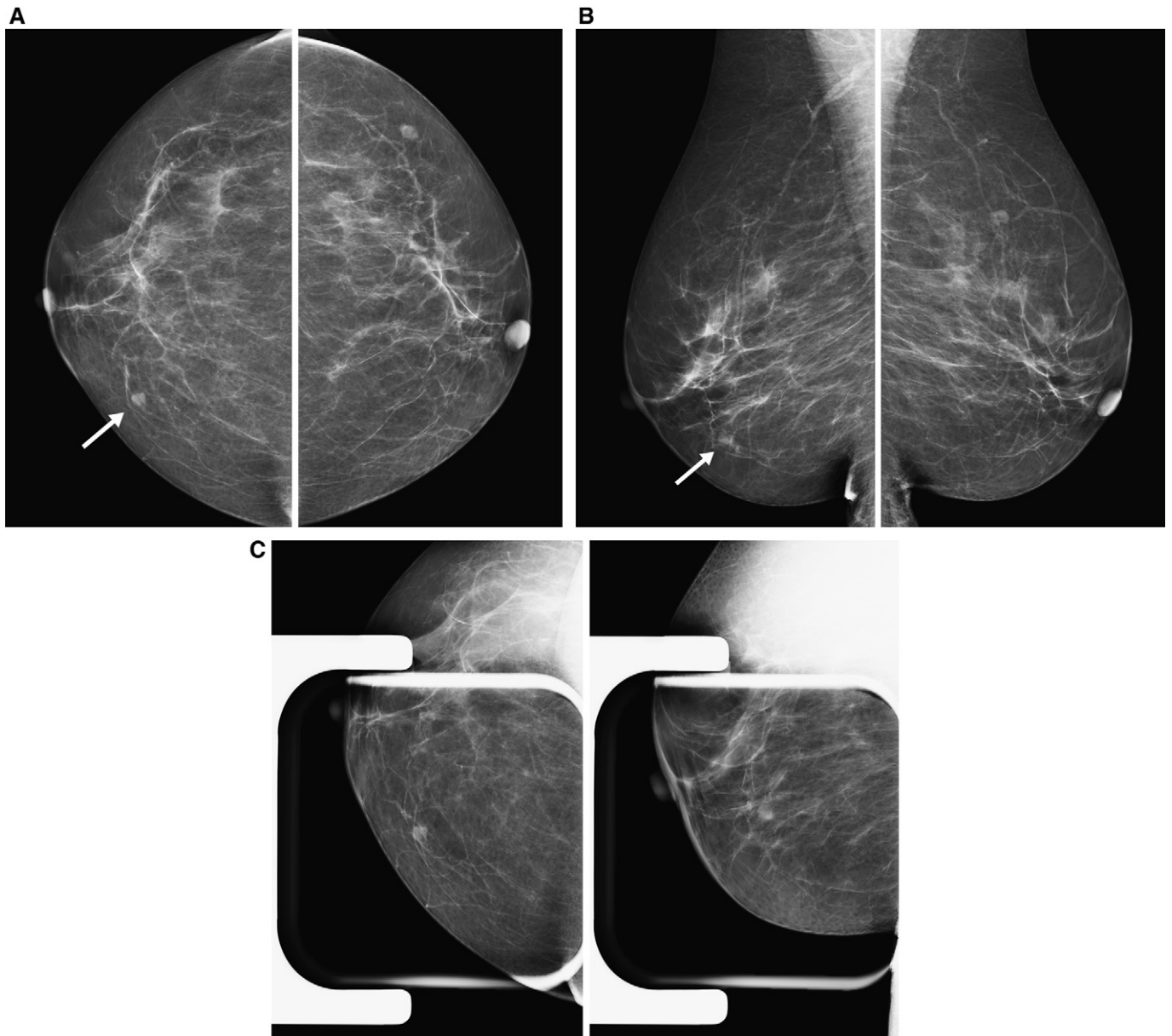
Figure 8. A 60-year-old woman for screening. (A) Craniocaudal and (B) mediolateral oblique views from screening mammogram show a lobular 5-mm nodule in the medial inferior right breast (arrow), which was new. (C) Right spot compression views, demonstrating an ill-defined margin (arrow). No corresponding sonographic finding was seen, so this mass was biopsied by using stereotactic guidance and revealed mucinous carcinoma.

delay in diagnosis must cause physical or emotional injury to the patient [18]. Imaging features that are more commonly overlooked or misinterpreted on mammographic examinations pose an increased malpractice risk and include edge of film findings, suspicious but stable morphology, developing asymmetry, architectural distortion, benign-appearing nodules, diffusely infiltrating tumours, and scar carcinomas.

Radiologists can minimize their malpractice risk while continuing to provide high-quality breast imaging to patients by increasing their awareness of the subtle imaging characteristics associated with these types of cases. Other methods to reduce missing breast cancer include: (1) clear concise communication and documentation with both patients and referring physicians; (2) establishment and adherence to standardized imaging protocols at the facility; (3) correlation of imaging with available patient history and prior studies to look for subtle changes; (4) integration of double reading and/or CAD for mammographic examinations; (5) insistence on high-quality positioning and technical parameters to ensure that the breast is adequately imaged; and (6) use of adjunctive imaging tools, such as ultrasound and breast MRI, to further evaluate indeterminate findings seen on conventional mammographic imaging.
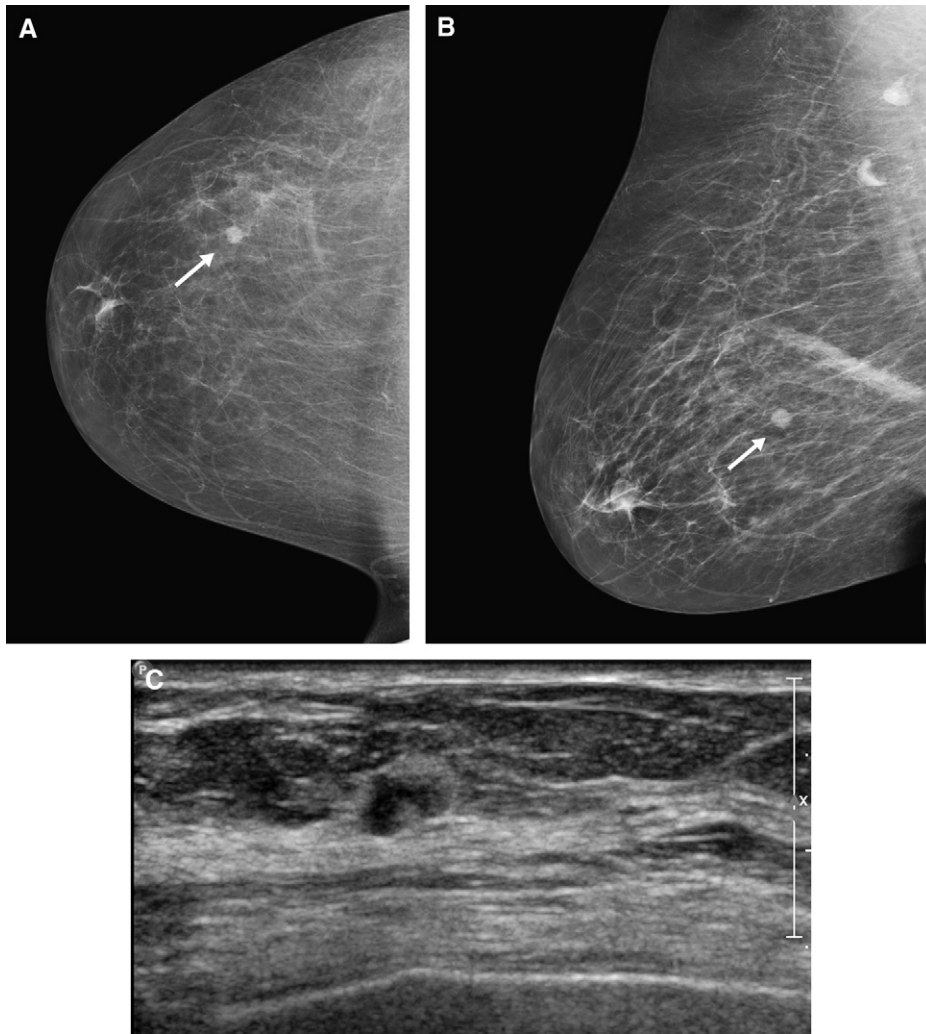
Figure 9. A 79-year-old woman presented for a second 6-month follow-up of a presumed benign intramammary lymph node in the right breast. (A) Craniocaudal and (B) mediolateral oblique views from diagnostic mammogram, showing a nodule along the central outer right breast (arrow). (C) Sagittal ultrasound images, showing a hypoechoic solid mass with irregular borders that was pathologically proven grade I invasive ductal carcinoma. Note that the sonographic appearance did not meet criteria for a lymph node and, in fact, represents a mass with heterogeneous echotexture and suspicious features.
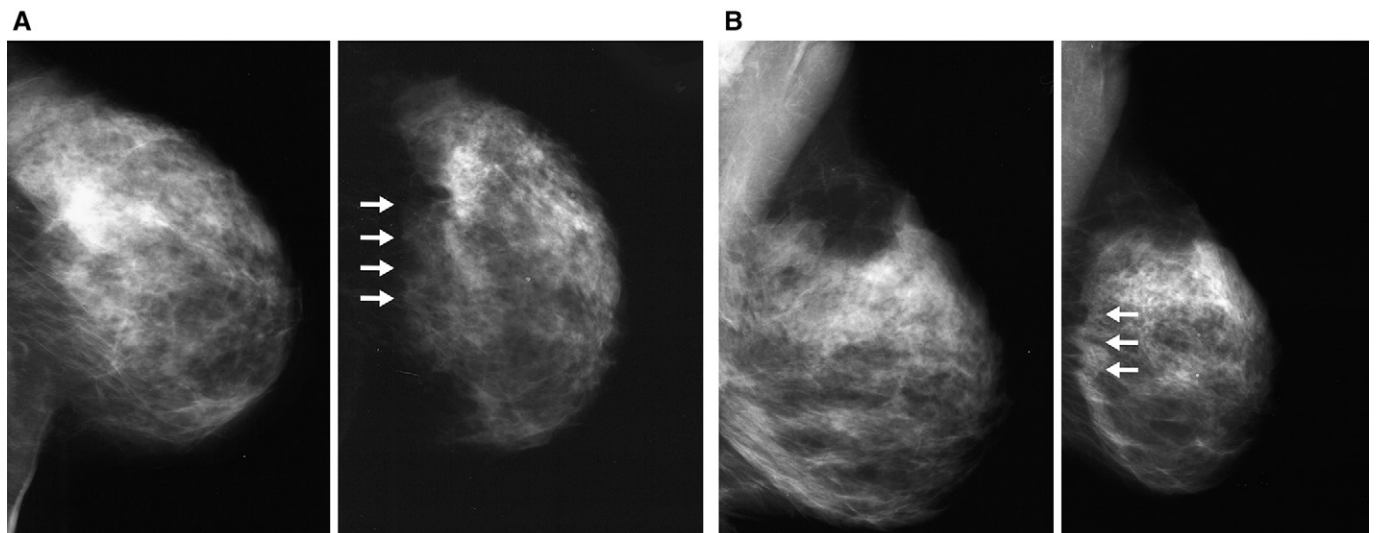

Figure 10. A 47-year-old woman presented for screening. (A) Craniocaudal and (B) mediolateral oblique (MLO) views from left mammograms dated 3 years apart, showing a decrease in the size of the breast, best seen on the MLO view, and retraction of the normal breast parenchyma from the chest wall (arrows) over time, giving the appearance of a denser breast. This was because of pathologically proven diffuse involvement of infiltrating lobular carcinoma.
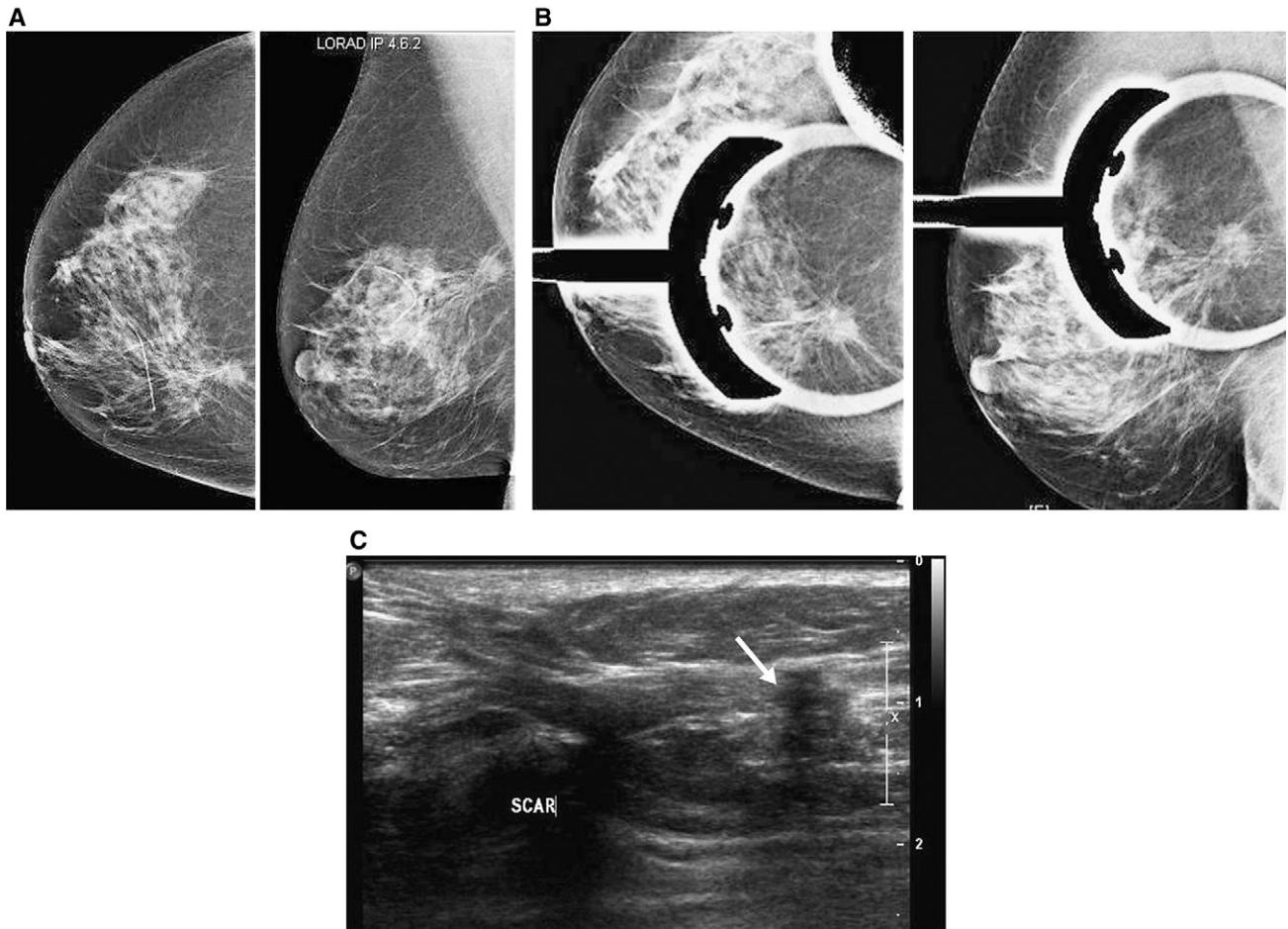
Figure 11. A 63-year-old woman with a history of 2 benign right breast excisional biopsies 8 years before presentation. (A) Craniocaudal (CC) and mediolateral oblique (MLO) right mammographic views of the right breast, showing a dense mass along the deep medial upper breast adjacent to the post-surgical distortion. (B) Spot compression CC and MLO views, better demonstrating the spiculated mass. (C) Ultrasound in the radial plane, showing a hypoechoic irregular mass with posterior shadowing (arrow) adjacent to the scar. Biopsy of this finding confirmed a grade 1 invasive ductal carcinoma.

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