

Mammographic Breast Asymmetry: Demographic, Clinical, Imaging, and Pathological Characteristics

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Abstract

Background: Mammographic breast asymmetries comprise a spectrum of findings that do not conform to the definition of a mass. They are most often benign but may also represent an underlying malignancy. This study aimed to determine the frequency, demographic and clinical profile, and imaging characteristics of mammographic asymmetries (asymmetry, focal, and global), and to assess the proportion of malignancy and the clinical and imaging features associated with malignancy.

Methods: This prospective study was conducted in the Department of Radiodiagnosis, Dr. Ram Manohar Lohia Institute of Medical Sciences, from May 2, 2020, to April 30, 2021. Women undergoing bilateral mammography whose mammograms demonstrated an asymmetry were included. Demographic and clinical information was recorded, followed by assessment of mammographic breast composition, type and location of asymmetry, and associated imaging findings. Digital breast tomosynthesis and targeted high-resolution ultrasonography were performed for further evaluation. The appropriate Breast Imaging Reporting and Data System (BI-RADS) category was assigned after complete imaging assessment. Lesions categorized as BI-RADS 4 or higher underwent fine-needle aspiration cytology or biopsy for pathological diagnosis. Cases assigned BI-RADS 1-3 were followed according to the prescribed imaging follow-up protocol.

Results: Of 1,324 bilateral mammographic examinations, mammographic asymmetry was identified in 120 (9.1%) examinations. Asymmetry was observed in 36 (30.0%) cases, global asymmetry in 16 (13.3%), and focal asymmetry in 68 (56.7%). Targeted ultrasonography demonstrated no focal abnormality in 60 (50.0%) cases, benign/probably benign findings in 36 (30.0%), and suspicious findings in 24 (20.0%). Fine-needle aspiration cytology or biopsy was performed in 24 (20.0%) cases, of which 20 (83.3%) were diagnosed as malignant.

Conclusion: Mammographic asymmetries are frequently benign but may occasionally represent the only imaging indication of underlying malignancy. Complete mammographic and sonographic evaluation, followed by appropriate BI-RADS assessment, is important for determining the need for pathological evaluation or imaging follow-up.

Categories: Radiology, Palliative Care

Keywords: asymmetry, breast, digital breast tomosynthesis, mammography, sonography

Introduction

Breasts usually have a symmetric appearance on mammography [1]. Further evaluation with targeted ultrasonography, digital breast tomosynthesis, and, when indicated, tissue sampling may help characterize mammographic asymmetries and distinguish benign findings from lesions requiring pathological assessment. Mammographic asymmetries are encountered in approximately 3% of mammographic examinations [2]. They comprise a spectrum of findings that do not conform to the definition of a mass. A mass is a three-dimensional lesion seen on two different mammographic projections and demonstrating completely or partially convex outward borders. In contrast, asymmetries generally demonstrate concave outward borders and are interspersed with surrounding fat. According to the current Breast Imaging Reporting and Data System (BI-RADS) lexicon, mammographic asymmetries are classified as asymmetry, focal asymmetry, and global asymmetry [3-5].

Mammographic asymmetries are most commonly benign and may represent summation of normal breast tissue, variation in the distribution of fibroglandular tissue, postoperative change, or hormonal effects. However, an asymmetric area may also represent an underlying lesion or malignancy [4-9]. The reported likelihood of malignancy among mammographic asymmetries varies according to the type of asymmetry and the population studied [10-18]. Accordingly, asymmetries are assigned an appropriate BI-RADS category on the basis of their morphology and associated imaging findings [3,4,18].

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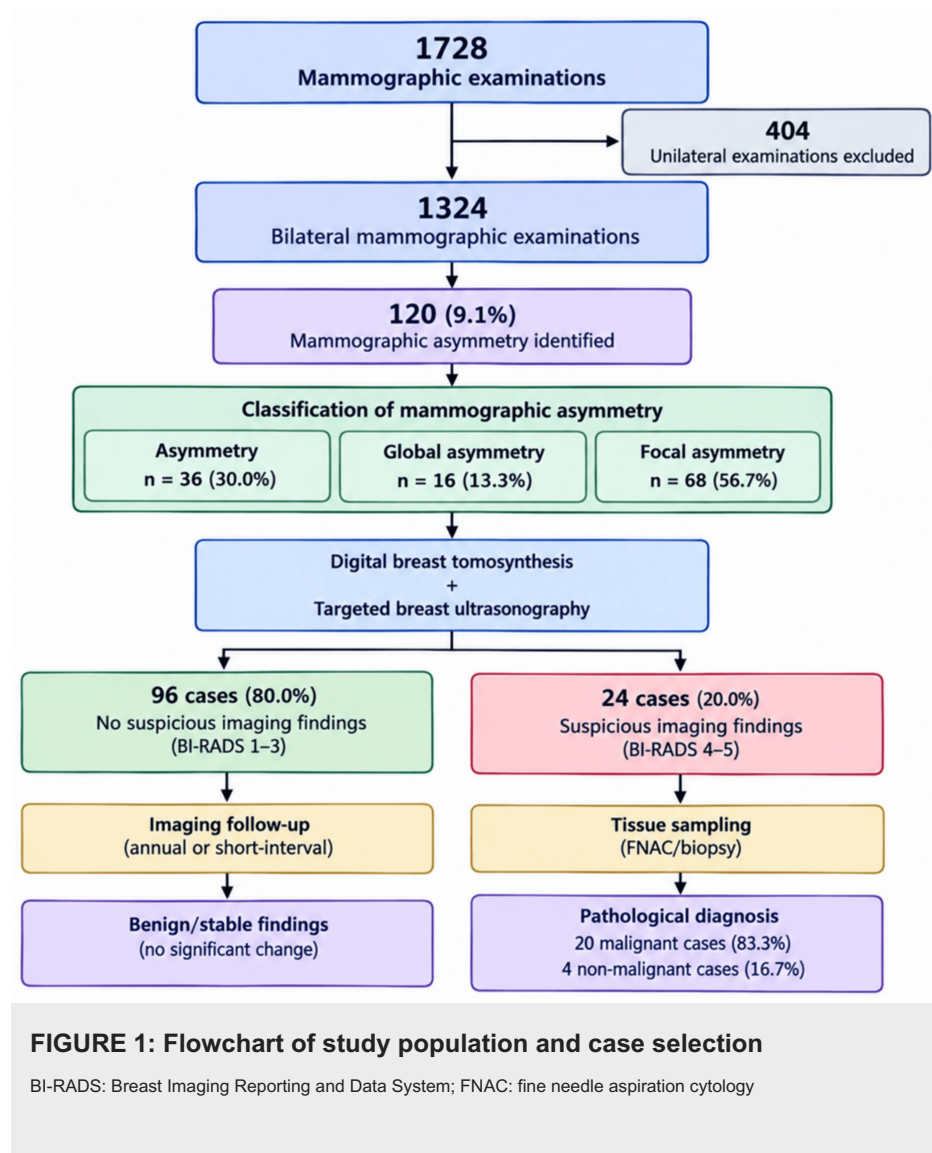
Ultrasonography may provide an important complementary role in the evaluation of mammographic asymmetries by identifying an underlying focal abnormality or confirming benign tissue characteristics [19–21]. The present study aimed to determine the frequency, demographic and clinical profile, and imaging characteristics of mammographic asymmetries (asymmetry, focal, and global), and to assess the proportion of malignancy and the clinical and imaging features associated with malignancy.

Materials And Methods

This prospective observational study was conducted in the Department of Radiodiagnosis, Dr. Ram Manohar Lohia Institute of Medical Sciences, after approval from the Institutional Ethics Committee (approval no. 42/18-RMLIMS/2020). The study was conducted from May 2, 2020, to April 30, 2021. Women presenting to the institutional outpatient departments with breast-related complaints or a family history of breast cancer who subsequently underwent bilateral mammography were considered for inclusion. During the study period, the institution did not operate a routine population-based breast cancer screening program. Most mammographic examinations were therefore performed for diagnostic indications; however, a small number of asymptomatic women underwent mammography for individual screening or clinical risk assessment. Written informed consent was obtained from participants. The study did not involve animals.

Sample size and technique

A convenience sampling approach was used, and all eligible bilateral mammographic examinations performed during the study period were considered for inclusion. During the study period, 1,728 mammographic examinations were performed in the mammography/tomosynthesis unit. Of these, 404 were single-breast examinations, performed primarily for evaluation of the remaining breast following contralateral mastectomy, and were excluded. The remaining 1,324 bilateral mammographic examinations constituted the study population. Mammographic asymmetry was identified in 120 examinations according to the American College of Radiology (ACR) BI-RADS lexicon and the predefined study categories of asymmetry, focal asymmetry, and global asymmetry [3]. These 120 examinations constituted the final study cohort (Figure 1).



Inclusion criteria

Women who underwent bilateral screening or diagnostic mammography at our institution during the study period and whose mammograms (MMGs) demonstrated any of the predefined mammographic asymmetry categories (overall asymmetry, focal asymmetry, or global asymmetry) were included.

Exclusion criteria

Examinations performed as unilateral mammography, including examinations performed because only one breast remained following contralateral mastectomy, were excluded. Examinations without evidence of mammographic asymmetry were not included in the final asymmetry cohort.

Data collection

After obtaining informed consent, demographic and clinical information was recorded, including age, marital status, presenting complaint, duration of symptoms, indication for mammography, menopausal status, personal and family history of breast cancer, history of hormone replacement therapy, and previous mammography. All included participants underwent bilateral digital mammography and high-resolution ultrasonography. Mammographic images were assessed for breast composition, type and location of asymmetry, and associated findings including mass, architectural distortion, microcalcifications, and axillary lymphadenopathy.

Equipment used

Mammographic examination was performed on a Sonographic Essential 54020/CESMI/Senoclaire A.6 unit (GE Healthcare, France). Ultrasound examination was performed on an ultrasound scanner (Supersonic AIXPLORER Multiwave, version 12.2.0.808, SuperSonic Imagine S.A., France). A high-resolution linear array

(7–10 MHz) transducer was used to perform the scan.

Mammography technique and image interpretation

The MMGs/tomograms were obtained by two experienced technologists. Digital MMG of both breasts was done, and standard mammographic views (craniocaudal and mediolateral oblique) were obtained. Images were analyzed, and interpretation was done at the workstation. MMGs were interpreted on the same day by two experienced breast radiologists with 15 and 10 years of experience, respectively. The MMGs were thoroughly interpreted for breast composition type and asymmetries. Site and type (asymmetry/focal/global) of asymmetries were ascertained. Associated features (mass lesion, architectural distortion, microcalcifications, and axillary lymph node status) were also noted. Digital breast tomosynthesis was performed in all our cases showing breast asymmetry on the standard views.

Breast ultrasound technique and image interpretation

The sonographic examination was performed with the patient in supine position, and the patient's arm flexed behind the head. Asymmetries located on the outer aspect of the breast were scanned with the patient in the contralateral oblique position. All sonographic examinations were performed by the same radiologists who interpreted MMGs. The sonographic examinations were targeted at the area corresponding to the asymmetry, and transverse and longitudinal images were obtained. The remaining bilateral breast parenchyma was also scanned radially, and all associated/additional findings were noted.

Mammographic asymmetry and BI-RADS assessment

Mammographic asymmetries were classified according to the ACR BI-RADS lexicon as asymmetry, focal asymmetry, or global asymmetry. We defined an asymmetry as an area of fibroglandular-density tissue visible on only one standard mammographic projection. A focal asymmetry was defined as an area of fibroglandular-density tissue visible on two different mammographic projections and occupying a relatively small portion of the breast. We defined a global asymmetry as a large volume of asymmetric fibroglandular tissue involving a substantial portion of one breast, generally at least one quadrant, without an associated mass, architectural distortion, or suspicious calcification. The descriptor “developing asymmetry” was not used as a separate category in the present study.

Breast composition was classified according to the ACR BI-RADS breast composition categories, i.e., category A (almost entirely fatty), category B (scattered areas of fibroglandular density), category C (heterogeneously dense, which may obscure small masses), and category D (extremely dense, which lowers the sensitivity of mammography). For statistical analysis, categories A and B were grouped as relatively fatty breasts, whereas categories C and D were grouped as dense breasts.

After complete mammographic, tomosynthesis, and ultrasonographic evaluation, an ACR BI-RADS final assessment category was assigned. The BI-RADS assessment categories were defined as category 0 (incomplete-additional imaging evaluation and/or comparison with prior examinations required), category 1 (negative), category 2 (benign finding), category 3 (probably benign, with short-interval follow-up recommended), category 4 (suspicious abnormality, for which tissue diagnosis should be considered), category 5 (highly suggestive of malignancy, for which appropriate action should be taken), and category 6 (known biopsy-proven malignancy). Subjects assigned BI-RADS category 4 or higher underwent tissue sampling for pathological diagnosis when clinically appropriate [3].

Pathological diagnosis

Samples for pathological diagnosis were obtained through fine needle aspiration, core biopsy, or surgical tumor excision (as requested by the clinician). Fine needle aspiration cytology (FNAC) and biopsy procedures were ultrasound-guided and were performed using a 25G spinal needle FNAC/BARD Mission Disposable Core Biopsy Instrument Kit (14G × 10 cm) (biopsy). Pathological diagnosis of subjects who underwent FNAC/biopsy/tumor excision was obtained [22,23].

Follow-up

Follow-up imaging was done strictly adhering to the ACR-BI-RADS protocols [3]. Our study subjects who were assigned BI-RADS 1/2 category were kept on annual follow-up, whereas subjects who were assigned BI-RADS 3 category were kept on short-interval (six-monthly) follow-up. The follow-up imaging protocol was similar to the initial imaging protocol and included MMG scan of bilateral breasts followed by high-resolution ultrasound (HRUSG) of bilateral breasts. Comparison was done with previous imaging, and appearance of suspicious findings (if any) was noted. Interval changes in the area or density of asymmetries were also noted (Figure 2).

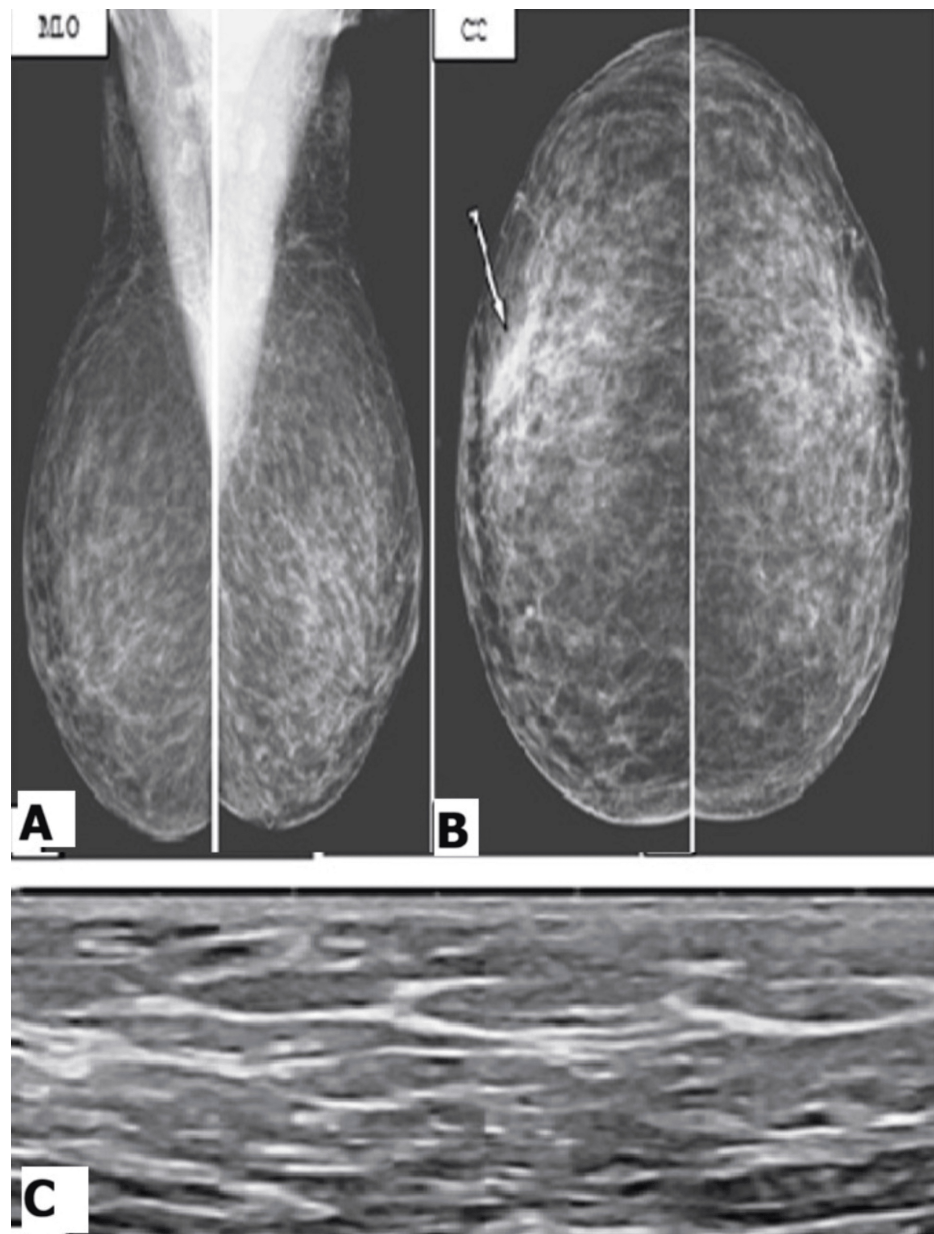


FIGURE 2: (A) Mammogram of a 45-year-old woman who came for a screening mammogram. (B) The right breast mammogram showing asymmetry (white arrow), as seen on the outer aspect in the CC view. (C) Targeted USG revealing normal underlying fibroglandular tissue

CC: craniocaudal; USG: ultrasound

Statistical analysis

The data were entered into a Microsoft Excel (Microsoft Corporation, Redmond, WA) spreadsheet and analyzed. Statistical analysis was performed with Statistical Package for the Social Sciences software (version 23, IBM Corporation, Armonk, NY). Summarization of quantitative data was done using the mean, median, and standard deviation. Statistical significance was determined with the chi-square test, and a 95% confidence interval (CI) was used; statistical significance was considered at a p value of <0.05 . Relative risk (RR) is calculated as the risk of malignancy in the first-listed category divided by the risk in the reference category. The 95% CI is calculated using the log-RR (Katz) method. Because several cells are small, Fisher's exact test is used for the p value.

Results

The demographic and clinical characteristics of subjects are summarized in Table 1. During the study period,

1,728 mammographic examinations were performed. We excluded 404 unilateral examinations, leaving 1,324 bilateral mammographic examinations for evaluation. Mammographic asymmetry was identified in 120 (9.1%) examinations. Among the 120 women included in the final cohort, the mean age was 44.9 years, and the median age was 45 years (range, 35-65 years). Twenty-eight women (23.3%) were postmenopausal, 40 (33.3%) were perimenopausal, and 52 (43.3%) were premenopausal. Four women (3.3%) had a family history of breast cancer, and none reported a history of hormone replacement therapy. Twelve women (10.0%) were asymptomatic and underwent mammography for screening or individual clinical risk assessment, whereas 108 (90.0%) underwent diagnostic mammography because of breast-related symptoms. Among the symptomatic women, 48 (40.0%) had a palpable breast lump, 20 (16.7%) had nipple discharge, 36 (30.0%) had breast pain, and four (3.3%) had both breast pain and nipple discharge.

Variable	Value
Age (years)	
Mean	44.9
Median	45.0
Range	35-65
Sex, n (%)	
Female	120 (100.0%)
Race, n (%)	
Asian	120 (100.0%)
History of hormone replacement therapy, n (%)	
No	120 (100.0%)
Menopausal status, n (%)	
Postmenopausal	28 (23.3%)
Premenopausal	52 (43.3%)
Perimenopausal	40 (33.3%)
Breast cancer history, n (%)	
Family history	4 (3.3%)
Previous mammography among women with a positive family history	4 (100.0%)*
Presentation	
Asymptomatic (screening mammography)	12 (10.0%)
Symptomatic (diagnostic mammography)	108 (90.0%)
Chief complaint among symptomatic women, n (%)	
Palpable breast lump	48 (40.0%)
Nipple discharge	20 (16.7%)
Breast pain	36 (30.0%)
Breast pain with nipple discharge	4 (3.3%)

TABLE 1: Demographic and clinical characteristics of the study population (n = 120)

*Percentage calculated among the four women with a positive family history

Imaging and pathological characteristics of the mammographic asymmetries are summarized in Table 2. Asymmetry was noted in 36 (30.0%) cases, of which 28 involved the right breast and eight involved the left breast. Digital breast tomosynthesis (DBT)/targeted USG revealed no focal abnormality or benign findings, in the form of dense fibroglandular tissue, in 32 cases (88.9%). On USG, four cases (11.1%) showed dilated

ducts with thickened walls and subsequently underwent FNAC. The pathological diagnosis in these cases was ductal carcinoma in situ. Global asymmetry was noted in 16 (13.3%) cases, all involving the right breast. On USG, normal breast parenchyma or benign findings were noted in 12 cases (75.0%), whereas four cases (25.0%) showed suspicious findings in the form of dilated ducts with intraductal soft-tissue content and intraductal vascularity. The suspicious case underwent USG-guided FNAC, which revealed infiltrating ductal carcinoma. Focal asymmetry was seen in 68 (56.7%) cases, of which 12 were bilateral. Sonographic examination revealed no focal abnormality in 32 cases (47.1%), benign/probably benign findings in 20 cases (29.4%), and suspicious findings in 16 cases (23.5%). The benign/probably benign findings included dense fibroglandular tissue, dilated ducts with fine internal echoes, and cysts with fine internal echoes. The suspicious findings included dilated ducts with internal debris and periductal vascularity, dilated ducts with thickened walls and intraductal echogenic content with scattered microcalcifications, and dilated ducts with intraductal soft tissue and vascularity, with or without associated microcalcifications. All 16 suspicious cases underwent pathological evaluation; four were diagnosed as infiltrating ductal carcinoma and 12 as ductal carcinoma in situ.

Type of asymmetry	Site	Sonographic findings	n (%)	Pathological diagnosis
Asymmetry (n = 36; 30.0%)	RB: 28, LB: 8, BB: 0	No focal abnormality	24 (20.0)	-
		Benign/probably benign: dense fibroglandular tissue	8 (6.7)	-
		Suspicious: dilated ducts with thickened walls	4 (3.3)	Ductal carcinoma in situ
Global (n = 16; 13.3%)	RB: 16, LB: 0, BB: 0	No focal abnormality	4 (3.3)	-
		Benign/probably benign: dense fibroglandular tissue	4 (3.3)	-
		Benign/probably benign: dilated ducts	4 (3.3)	-
		Suspicious: dilated ducts with intraductal soft tissue and vascularity	4 (3.3)	Infiltrating ductal carcinoma
Focal (n = 68; 56.7%)	RB: 28, LB: 28, BB: 12	No focal abnormality	32 (26.7)	-
		Benign/probably benign: dense fibroglandular tissue	12 (10.0)	-
		Benign/probably benign: dilated ducts with fine internal echoes	4 (3.3)	-
		Benign/probably benign: cyst with fine internal echoes	4 (3.3)	Breast abscess
		Suspicious: dilated ducts with internal debris and periductal vascularity	4 (3.3)	Infiltrating ductal carcinoma
		Suspicious: dilated ducts with thickened walls, intraductal echogenic content, and scattered microcalcifications	4 (3.3)	Ductal carcinoma in situ
		Suspicious: dilated ducts with intraductal soft tissue and vascularity	4 (3.3)	Ductal carcinoma in situ
		Suspicious: dilated ducts with intraductal soft tissue and vascularity with associated microcalcifications	4 (3.3)	Ductal carcinoma in situ

TABLE 2: Sonographic and pathological findings according to the type of mammographic asymmetry (n = 120)

RB: right breast; LB: left breast; BB: both breast

Of the 120 study cases, 20 were confirmed to have malignancy, and 100 had no diagnosis of malignancy. Among the 100 nonmalignant cases, 96 (96.0%) underwent imaging follow-up, while four (4.0%) had nonmalignant pathological diagnoses following tissue sampling. The 96 cases undergoing follow-up comprised 40 cases (41.7%) scheduled for routine annual follow-up and 56 cases (58.3%) scheduled for short-interval imaging follow-up. Among the 40 cases scheduled for annual follow-up, 32 (80.0%) were cases of asymmetry and 8 (20.0%) were cases of global asymmetry. None of these cases demonstrated a significant HRUSG correlate at the time of initial imaging. On follow-up mammography, 24 (75.0%) of the 32 asymmetry cases showed complete resolution of the previously noted asymmetry, consistent with a summation artifact, while the remaining eight (25.0%) showed no significant interval change. All eight cases of global asymmetry also showed no significant interval change. Among the 56 cases undergoing short-interval follow-up, 52 (92.9%) were cases of focal asymmetry and four (7.1%) were cases of global asymmetry. Twelve cases (21.4%) demonstrated a positive HRUSG correlate, comprising eight cases of focal asymmetry and four cases of global asymmetry. These findings remained stable at follow-up, with no significant increase in the density or extent of the asymmetry on mammography and no development of suspicious sonographic features (Table 3).

Follow-up assessment	Asymmetry, n (%)	Global asymmetry, n (%)	Focal asymmetry, n (%)	Total, n (%)
Annual follow-up	32 (80.0)	8 (20.0)	-	40 (100.0)
No significant HRUSG correlate	32 (100.0)	8 (100.0)	-	40 (100.0)
Resolution on follow-up MMG	24 (75.0)	-	-	24 (60.0)
No significant interval change	8 (25.0)	8 (100.0)	-	16 (40.0)
Short-interval follow-up	-	4 (7.1)	52 (92.9)	56 (100.0)
Positive HRUSG correlate	-	4 (100.0)	8 (15.4)	12 (21.4)
↳Complicated cyst with low-level echoes	-	-	4 (7.7)	4 (7.1)
↳Smooth-walled dilated ducts	-	4 (100.0)	4 (7.7)	8 (14.3)
Stable on follow-up MMG/HRUSG	-	4 (100.0)	52 (100.0)	56 (100.0)
Overall follow-up cohort	32	12	52	96

TABLE 3: Follow-up imaging findings and outcomes of mammographic asymmetries

MMG: mammography; HRUSG: high-resolution ultrasonography

Among the 20 women with pathologically confirmed malignancy, four (20.0%) had a palpable breast lesion, whereas 16 (80.0%) were nonpalpable. Eight (40.0%) malignant cases occurred in women with dense breast composition (ACR C/D), while 12 (60.0%) occurred in women with relatively fatty breast composition (ACR A/B). Associated suspicious mammographic findings, including microcalcifications and/or architectural distortion in addition to the asymmetry, were present in eight (40.0%) malignant cases. All 20 malignant cases demonstrated a suspicious sonographic correlate at the site of the asymmetry, in the form of suspicious underlying dilated ducts containing soft-tissue components, as shown in Table 4.

Variable	Category	Malignant (n = 20), n (%)	Nonmalignant (n = 100), n (%)	RR (95% CI)	p value*
Palpability of asymmetry	Palpable	4 (20.0)	25 (25.0)	0.80 (0.31-2.05)	0.80
	Nonpalpable (Ref.)	16 (80.0)	75 (75.0)	1.00	-
Breast density	ACR C/D (dense)	8 (40.0)	35 (35.0)	1.14 (0.63-2.08)	0.81
	ACR A/B (relatively fatty) (Ref.)	12 (60.0)	65 (65.0)	1.00	-
Suspicious associated mammographic finding	Present	8 (40.0)	4 (4.0)	10.00 (3.33-30.04)	<0.001
	Absent (Ref.)	12 (60.0)	96 (96.0)	1.00	-
Suspicious sonographic correlate at the site of asymmetry	Present	20 (100.0)	4 (4.0)	25.00 (9.57-65.31)	<0.001
	Absent (Ref.)	0 (0.0)	96 (96.0)	1.00	-

TABLE 4: Association of clinical and imaging characteristics with malignancy among study subjects

*p values were calculated using the two-sided Fisher's exact test. The nonmalignant group comprised 100 cases without a diagnosis of malignancy; 96 underwent imaging follow-up, and four had nonmalignant pathological diagnoses following tissue sampling. For each variable, the category designated "Ref." was used as the reference category for calculation of RR. RR and 95% CI were calculated using the log-RR (Katz) method. For the suspicious sonographic correlate variable, the malignant group contained no cases in the reference category; therefore, the RR represents the ratio of the observed malignancy risks (100% vs. 4%) and should be interpreted in the context of the zero cell

RR: relative risk; CI: confidence interval; ACR: American College of Radiology

Discussion

Mammographic asymmetries are commonly benign and may reflect normal variation in the distribution of fibroglandular tissue or summation of overlapping breast tissue. However, an asymmetry associated with suspicious mammographic findings, such as microcalcifications, architectural distortion, or a palpable abnormality, warrants further diagnostic evaluation [3-5]. In the present study, suspicious mammographic and sonographic findings were identified in a subset of cases, and pathological evaluation confirmed malignancy in 20 cases.

In our study, among the 36 cases classified as asymmetry, 24 (66.7%) demonstrated no focal abnormality on DBT/targeted ultrasonography, while eight (22.2%) demonstrated benign dense fibroglandular tissue. Four cases (11.1%) demonstrated suspicious findings, which is consistent with retrospective reviews of cases of missed breast cancers wherein 9%-38% of missed cancers were initially visible as asymmetry [17,24]. An "asymmetry" is an area of fibroglandular-density tissue visible only on one standard mammographic projection [3-5]. It is seen in ~3.3% of MMGs [4]. Asymmetry was identified in 2.7% of all bilateral mammographic examinations in our study. Among the mammographic asymmetry categories in our study, asymmetry represented 30% of cases. This percentage is higher than those observed by Wessam et al. [25] (8%) and Mokhtar et al. [26] (12%). The overall likelihood of malignancy in asymmetry is less than 2% [4,10]. The commonest cause of this spectrum is an overlap of breast tissue, also known as "summation artifact." In a study by Sickles [10], 82.7% of cases of asymmetry were due to summation artifact. The likelihood of malignancy for the remaining nonsummation asymmetry is 10.3% [3].

"Global asymmetry" is visible on two different mammographic projections and represents a large amount of fibroglandular density tissue in one breast compared with the contralateral breast, occupying at least one or more breast quadrants. The definition of global asymmetry also excludes any associated mammographic finding such as a mass lesion, architectural distortion, or microcalcifications [3-5]. It is seen in ~3% of mammographic examinations [4] and usually represents a normal variant unless proven otherwise [2-5,8]. Global asymmetry was seen in ~1.2% of our mammographic examinations. Among the mammographic asymmetry categories, global asymmetry represented 13.3% of cases. The percentage of global asymmetry in our study is lower compared with the study by Wessam et al., who reported global asymmetry in 26% of cases [25]. Our observation is in accordance with observations by Mokhtar et al., who reported global asymmetry in 14% of cases [26]. Seventy-five percent of our global asymmetry cases showed benign findings. Four cases

(25%) showed suspicious findings and turned out to be infiltrating ductal carcinoma. Kopans reported malignancy in three of 20 (15%) biopsied cases of global asymmetry [8]. In our study, four of 16 cases of global asymmetry underwent pathological evaluation, of which one (25.0%) was diagnosed as malignant. Although the malignancy rate in our series was numerically higher than that reported by Kopans (25.0% vs. 15.0%), the findings are broadly comparable, considering the small number of biopsied cases in both studies. The percentage of suspicious global asymmetry (25%) in our study is lower than that reported by Wessam et al. (73%) and Mokhtar et al. (62.5%), respectively [25,26].

Focal asymmetry is visible on two different mammographic projections and represents a relatively small area of fibroglandular tissue involving less than one quadrant [3-5]. It differs from global asymmetry primarily in the volume of breast tissue involved. In the present study, focal asymmetry accounted for 68 (56.7%) of the 120 mammographic asymmetry cases. Sixteen (23.5%) focal asymmetry cases demonstrated suspicious sonographic findings and underwent pathological evaluation, with four cases diagnosed as infiltrating ductal carcinoma and 12 as ductal carcinoma in situ. Overall, 12 of the 68 focal asymmetry cases (17.6%) had a pathological diagnosis of malignancy. In the Western population, focal asymmetry has been reported in 1%-3% of mammographic examinations. The frequency of focal asymmetry in our scenario is higher than that in the Western population [12-15]. However, this percentage is less than those observed by Wessam et al. (70%) and Mokhtar et al. (72%), respectively [25,26]. The proportion of malignancy in our focal asymmetry subgroup was higher than that reported in several screening-based Western series wherein the likelihood of malignancy in focal asymmetry was less than 1% [9-12]. However, this comparison should be interpreted cautiously because our study population predominantly comprised women undergoing diagnostic mammography at a tertiary-care referral center rather than a population-based screening cohort. Our findings are almost consistent with those observed by Mokhtar et al. and Abdul Wahid et al., who reported malignancy in 24% and 21.4% of cases of focal asymmetry, respectively [26,27].

The term "developing asymmetry" has been discontinued as a descriptor in the recent v2025 of the ACR-BI-RADS lexicon [3]. None of the asymmetries we encountered showed a change in appearance over time.

Limitations

This study has several limitations. First, it was conducted at a single tertiary-care center using a convenience sampling approach; therefore, the findings may not be directly generalizable to the wider population or to population-based screening settings. Second, the study population predominantly comprised women undergoing diagnostic mammography because of clinical indications, which may have resulted in selection and referral bias and may partly explain the relatively high proportion of suspicious and malignant lesions. Third, the number of cases within individual mammographic asymmetry categories, particularly global and focal asymmetry, was relatively small, limiting the precision of estimates of malignancy rates. Fourth, pathological verification was not performed for all asymmetries. Tissue sampling was undertaken when imaging findings warranted pathological evaluation; therefore, the benign status of nonbiopsied lesions was established primarily through imaging assessment and/or follow-up. This introduces the possibility of verification bias and limits definitive comparison between malignant and non-malignant lesions. Finally, the observational nature of the study and the absence of a population-based screening cohort preclude causal inference and limit the extent to which the observed associations can be extrapolated to other clinical settings. Accordingly, the findings should be interpreted primarily as descriptive data from a tertiary-care population.

Conclusions

Mammographic asymmetries were identified in 9.1% of bilateral mammographic examinations evaluated in this tertiary-care series. Most asymmetries demonstrated benign or no focal imaging correlates; however, a subset demonstrated suspicious mammographic or sonographic findings and required pathological evaluation. Among the lesions that underwent pathological assessment, malignancy was identified in 20 cases.

These findings highlight the importance of complete diagnostic evaluation of mammographic asymmetries, particularly when associated suspicious imaging features are present. Targeted ultrasonography and, where appropriate, tissue diagnosis can provide further characterization and guide subsequent management. Because this was a single-center study with convenience sampling and incomplete pathological verification of benign-appearing lesions, the findings should be interpreted within the context of the study population and should not be directly extrapolated to population-based screening populations.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Ethics Committee of Dr. Ram Manohar Lohia Institute of Medical Sciences issued approval 42/18-RMLIMS/2020. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** Saurabh Dwivedi declare(s) employment from Apex Diagnostics. The study was conducted from May 2, 2020, to April 30, 2021. At the time, Dr. Saurabh Dwivedi was a Senior Resident in the Department of Orthopedics at Maharshi Vashishtha Autonomous State Medical College, Basti, and an Assistant Professor in the Department of Orthopedics at the Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, India. After that, he left the college in 2023 and joined as a Consultant Orthopedic Surgeon at Apex Diagnostics. Hence, there is no role for Apex Diagnostics in the study design, data collection, analysis, interpretation, or other aspects of the research. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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