

Article

Radiologic Presentation of Invasive Ductal and Lobular Breast Carcinoma: A Single-Center Experience from Oman

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Abstract

Breast cancer is the most commonly diagnosed cancer among women worldwide and remains a leading cause of cancer-related mortality. The most frequent histological subtypes are invasive ductal carcinoma (IDC) and invasive lobular carcinoma (ILC), which demonstrate different biological behaviours and heterogeneous imaging features. ILC is more likely to produce subtle radiological findings such as architectural distortion or asymmetry, whereas IDC commonly presents as a well-defined mass with spiculated margins and associated calcifications. This retrospective cohort study was conducted at Sur Hospital, Oman, and included Omani female patients diagnosed with histologically confirmed IDC or ILC between 2017 and 2025. Mammographic and ultrasound features were reviewed in relation to age, breast density, tumour size, and BI-RADS classification. A total of 46 cases were included, of which 91.3% were IDC and 8.7% were ILC. The median age at diagnosis was 50 years, and the median tumour diameter was 3.0 cm. On mammography, masses with calcifications and architectural distortion were the most common findings. Ultrasound demonstrated predominantly irregular lesions with hypoechoic or heterogeneous echotexture. Most lesions were classified as BI-RADS IV or V. This study documents the mammographic and ultrasound patterns encountered in routine clinical practice. Because only four ILC cases were included, the ILC observations should be interpreted descriptively and should not be regarded as evidence of definitive subtype-specific differences.

Keywords: invasive ductal carcinoma; invasive lobular carcinoma; mammography; ultrasonography; breast density; BI-RADS classification; tumour size; Oman



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1. Introduction

Breast cancer is the most commonly diagnosed cancer among women worldwide and is a leading cause of cancer-related mortality [1]. In Oman, breast cancer is also reported as the most common cancer, predominantly affecting women [2]. Histologically, the most common subtypes are invasive ductal carcinoma (IDC) and invasive lobular carcinoma (ILC), with IDC representing about 70–80% of invasive breast neoplasms and ILC representing about 10–15% [3,4]. These entities have different histopathological features, different biological behaviors, and heterogeneous imaging features [5]. Compared to IDC, ILC is more likely to produce subtle or nonspecific radiological findings that can hamper diagnosis and increase diagnostic intervals [6]. ILC typically presents as a single-file infiltrative growth pattern with a minimal desmoplastic reaction leading to architectural

distortion or asymmetry instead of discrete mass formation [7,8]. Conversely, IDC is often manifested by a well-defined mass with spiculated margins, with associated calcifications on mammographic examinations [9]. Breast density has a significant effect on lesion conspicuity; high fibroglandular density reduces mammographic sensitivity by reducing the visibility of tumors and making it difficult to detect subtle abnormalities [10]. In patients with dense breast tissue, subtle asymmetries or architectural distortions may be particularly difficult to see, further complicating the difficulty of diagnosis inherent to ILC [6,10]. Ultrasonography is a useful adjunctive modality, especially in cases of dense breasts or equivocal findings on mammography, as it increases the conspicuity of lesions and aids in the application of BI-RADS classification [11,12]. Tumour size is an additional modulating factor; smaller tumours tend to have less distinctive morphological features and are much more likely to be associated with a degree of diagnostic uncertainty, while larger tumours are more conspicuous and can be more confidently characterised [13]. The BI-RADS classification system is playing a central role in the standardisation of radiological risk stratification, with categories IV and V representing moderate to high suspicion of malignancy [12]. A thorough knowledge of the distinctive radiological features of IDC and ILC, and their correlation with patient demographics and tumour characteristics, is paramount for enhancing diagnostic accuracy and patient management [5,6]. Accordingly, this study aimed to describe the mammographic and ultrasound features of histologically confirmed IDC and ILC in Omani female patients at a single institution, and to explore their relationship with age, breast density, tumour size, and BI-RADS classification. The purpose was not to assess diagnostic accuracy or clinical outcomes, but to report the imaging patterns encountered in routine radiological practice and interpret them in the institutional sample.

2. Materials and Methods

Study Design:

This retrospective cohort study was conducted at the Radiology Department of Sur Hospital, Oman. Imaging and clinical data from Omani female patients diagnosed with invasive ductal carcinoma (IDC) or invasive lobular carcinoma (ILC) between 2017 and 2025 were reviewed. Eligible patients were identified through institutional radiology and histopathology databases.

Study Population and Inclusion/Exclusion Criteria:

The inclusion criteria comprised Omani female patients aged 18 years or older with a histologically confirmed diagnosis of IDC or ILC based on biopsy performed at Sur Hospital, and with complete clinical and imaging data available within the Al Shifa TrakCare system, including patient age, breast composition, and tumour size. Exclusion criteria included non-Omani patients, biopsies performed outside Sur Hospital, a history of non-invasive breast cancer (such as ductal carcinoma in situ), incomplete or inadequate imaging data, and prior breast surgery or radiation therapy that could result in architectural distortion.

Data Collection and Imaging Review:

For each included patient, mammography and ultrasound examinations were retrospectively reviewed. Clinical data, including age at diagnosis, breast composition classified according to the BI-RADS density categories (A–D), and tumour size, were extracted from the Al Shifa TrakCare system. All patient data were anonymised to ensure confidentiality.

Mammography and ultrasound images were reviewed retrospectively through the institutional imaging archive. The initial review was performed by a radiology specialist and was subsequently verified by a senior radiology specialist, both with more than 5 years of experience in breast imaging. Discrepancies were resolved by consensus. Radiological

features assessed included lesion size, shape, margins, echogenicity, calcifications, architectural distortion, posterior acoustic features, and BI-RADS category, where documented. Tumour visibility was assessed by reviewing lesion conspicuity relative to the surrounding breast parenchyma. Interobserver agreement was not calculated because the final dataset was based on consensus review rather than independent blinded readings.

Statistical Analysis:

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the demographics, tumour characteristics, and imaging findings. Continuous variables were reported as mean $\pm$ standard deviation or median and interquartile range (IQR), while categorical variables were presented as frequencies and percentages. To compare the mean age at diagnosis between BI-RADS IV and V groups, the independent t-test was used. To compare the median tumour size between BI-RADS IV and V groups, the Mann–Whitney U test was performed. To compare categorical variables, the chi-square test was used. A p -value of ≤ 0.05 was considered statistically significant.

Ethical Approval:

Ethical approval was obtained from the Health Studies and Research Approval Committee of South Sharqiyah Governorate, Ministry of Health, Oman, under proposal ID MoH/CSR/25/29318 and reference number DGHS/GDPS/SSHQ/PROPOSAL_APPROVED/7/2025, dated 1 January 2025. This study adhered to the principles of the Declaration of Helsinki.

3. Results

The study included 46 cases of breast carcinoma. Most of the cases (91.3%) were invasive ductal carcinoma, while only four cases (8.7%) were diagnosed with invasive lobular carcinoma. The mean $\pm$ SD age at diagnosis was 53 ± 13.6 years. The distribution of age at diagnosis is shown in Figure 1. The median maximum tumour diameter was 3.0 (2.5) cm. The most reported mammographic feature was masses with calcification (45.7%), followed by architectural distortions, masses, and suspicious calcifications (39.1%, 23.9%, and 15.2%, respectively). Focal asymmetry was reported in 6.5% of cases. Table 1 compares mammographic findings across different breast densities and tumour types.

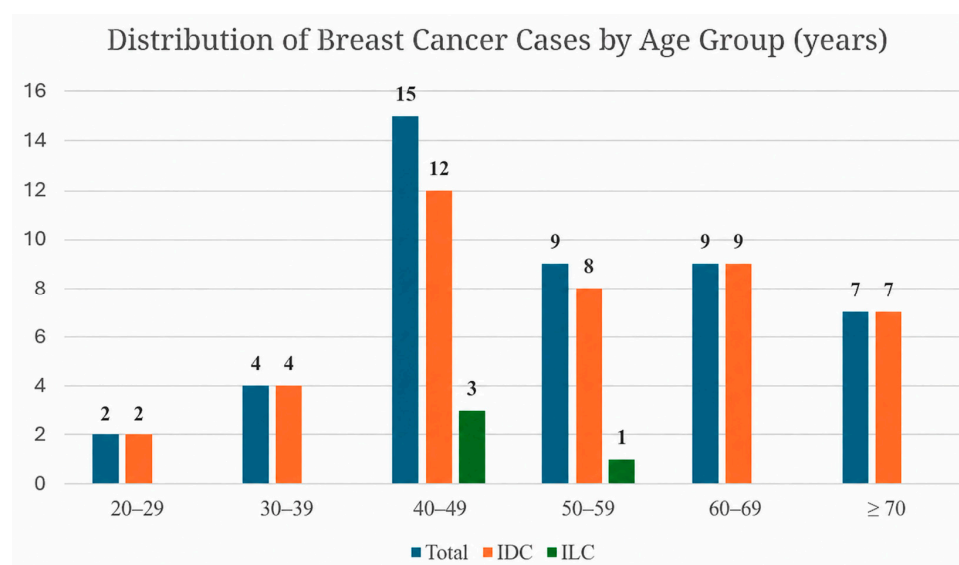


Figure 1. Distribution of breast cancer cases by age group (years). IDC: invasive ductal carcinoma; ILC: invasive lobular carcinoma.

Table 1. Comparison of mammography findings across different breast densities and tumour types.

		Mass		Mass with Calcification		Architectural Distortions		Focal Asymmetry		Suspicious Calcification	
		Yes	%	Yes	%	Yes	%	Yes	%	Yes	%
Breast Densities	A (<i>n</i> = 5)	1	20	3	60	1	20	0	-	1	20
	B (<i>n</i> = 20)	6	30	10	50	9	45	1	5	2	10
	C (<i>n</i> = 15)	4	26.7	8	53.3	6	40	2	13.3	3	20
	D (<i>n</i> = 2)	0	-	0	-	1	50	0	-	0	-
Tumor type	IDC (<i>n</i> = 42)	10	23.8	19	45.2	17	40.5	3	7.1	7	16.7
	ILC (<i>n</i> = 4)	1	25	2	50	1	25	0	-	0	-

Four patients were excluded from the breast density comparison due to missing data.

The breast lesions were evaluated using the BI-RADS classification based on ultrasound findings. In 13 (28.3%) cases, BI-RADS IV was reported, while in the other 33 (71.7%) cases, BI-RADS V was reported. The mean $\pm$ SD age at diagnosis in the BI-RADS IV group and BI-RADS V groups was 51 ± 16.9 and 53.9 ± 12.3 years, respectively. The difference in the age of diagnosis between the two groups did not reach statistical significance ($p = 0.530$). The median (IQR) tumor size in the BI-RADS IV group and BI-RADS V groups was 3.4 (4.4) and 2.9 (1.8) cm. The difference between the two groups did not reach statistical significance ($p = 0.164$). As for laterality, lesions on the right side were found in 22 (47.8%) cases, of which 6 were BI-RADS IV, and 16 were BI-RADS V. On the other hand, left-sided lesions were reported in 24 (52.2%) cases, of which 7 were BI-RADS IV, and 17 were BI-RADS V. Table 2 shows the ultrasound features reported in IDC and ILC. Table 3 compares the US findings in BI-RADS IV and V.

Table 2. Ultrasound features reported in IDC and ILC (%).

		IDC (<i>n</i> = 42)	ILC (<i>n</i> = 4)
Tumor shape	Oval	1 (3.4%)	-
	Irregular	28 (96.6%)	4 (100%)
Echo pattern	Hypoechoic	31 (83.8%)	1 (25%)
	Heterogeneous	6 (16.2%)	3 (75%)
Margins	Circumscribed	2 (5.7%)	0
	Angular	4 (11.4%)	0
	Microlobulated	11 (31.4%)	1 (25%)
	Spiculated	3 (8.6%)	0
	Macrolobulated	1 (2.9%)	0
	Ill-defined	7 (20%)	0
	Irregular	7 (20%)	3 (75%)
Calcification	Yes	18 (42.9%)	2 (50%)
Architectural distortion	Yes	10 (23.8%)	3 (75%)
Posterior acoustic features	Combined or none	32 (82.1%)	2 (50%)
	Shadowing	6 (15.4%)	1 (25%)
	Enhancement	1 (2.6%)	1 (25%)

Percentages were calculated based on available data for each ultrasound feature. Some variables had missing data; the percentage was calculated based on the available data.

Table 3. The US findings in BI-RADS IV and BI-RADS V.

		BI-RADS IV (<i>n</i> = 13)	BI-RADS V (<i>n</i> = 33)
Tumor shape	Oval	1 (11.1%)	0
	Irregular	8 (88.9%)	24 (100%)

Table 3. Cont.

		BI-RADS IV (n = 13)	BI-RADS V (n = 33)
Echo pattern	Hypoechoic	11 (91.7%)	21 (72.4%)
	Heterogeneous	1 (8.3%)	8 (27.6%)
Margins	Circumscribed	2 (16.7%)	0
	angular	0	4 (14.8%)
	Microlobulated	5 (41.7%)	7 (25.9%)
	Spiculated	0	3 (11.1%)
	Macrolobulated	1 (8.3%)	0
	Ill-defined	3 (25%)	4 (14.8%)
	Irregular	1 (8.3%)	9 (33.3%)
Calcification	Yes	3 (23.1%)	17 (51.5%)
Architectural distortion	Yes	2 (15.4%)	11 (33.3%)
Posterior acoustic features	Combined or none	10 (76.9%)	24 (80%)
	Shadowing	2 (15.4%)	5 (16.7%)
	Enhancement	1 (7.7%)	1 (3.3%)

Percentages were calculated based on available data for each ultrasound feature. Some variables had missing data; the percentage was calculated based on the available data. All comparisons between BI-RADS IV and V ultrasound findings were not statistically significant ($p > 0.05$).

4. Discussion

Distribution of Tumour Subtypes in the Institutional Cohort:

IDC was the most common presentation (91.3 per cent of cases), and ILC accounted for 8.7 per cent. The proportion of ILC was slightly below but broadly comparable with the approximately 10–15% reported in published literature. This distribution is consistent with known epidemiological data, which characterise the predominant histological type of invasive breast cancer as IDC and ILC—a relatively smaller proportion [3,4]. However, as only four ILC cases were included in the present study, the ILC findings should be interpreted descriptively and in comparison with the literature, rather than as definitive conclusions regarding subtype-specific imaging differences. The small number of ILC cases results in low statistical power; therefore, results should be interpreted with caution and confirmed by larger, multi-institutional studies.

Mammographic Features:

The most common mammographic findings in this group of malignant breast lesions were masses, often with associated calcifications, and architectural distortion. Calcific masses were the most frequently noted pattern, followed by distortion of the normal parenchymal architecture. These observations are consistent with previous reports that IDC is more likely to appear as a spiculated mass with associated microcalcifications [9]. In contrast, ILC is more likely to appear as an architectural distortion or a slight asymmetry without prominent calcifications [6,8]. In the present cohort, architectural distortion was observed in both IDC and ILC cases, but the small number of ILC cases limits direct comparison between tumour subtypes. Breast density may influence lesion visibility. In women with dense fibroglandular tissue, subtle findings such as faint asymmetries or indistinct margins may be harder to identify, and architectural distortion may be particularly hard to appreciate. These observations are supported by the evidence that the mammographic sensitivity in dense breasts is diminished due to the masking effect of fibroglandular tissue [10]. However, this study was not designed to directly measure mammographic sensitivity according to breast density.

Ultrasound Features:

Ultrasound examination showed features suggestive of malignant breast lesions; most tumours showed an irregular shape and predominantly hypoechoic echotexture [11]. IDC lesions had predominantly hypoechoic echotexture, whereas posterior acoustic features were variable [11]. Although the number of ILC cases was limited, a tendency toward heterogeneous echotexture and irregular margins was observed, consistent with the literature on ILC's infiltrative growth pattern and its sonographic variability [6,7]. Ultrasound served as a useful complementary modality, especially in patients with dense breast tissue or equivocal mammographic findings, to improve lesion conspicuity and assist with BI-RADS classification [11,12]. However, its incremental diagnostic value was not directly measured in this study.

BI-RADS Assessment and Tumour Size:

Most lesions were rated BI-RADS category IV or V, indicating moderate to high suspicion of malignancy [12]. The ultrasound features of BI-RADS IV and V lesions were compared, but the observed differences did not reach statistical significance. This distribution supports the usefulness of BI-RADS' categorization in standardizing radiologic risk stratification [12]. Tumour size was compared between BI-RADS IV and V groups, but no statistically significant difference was found. Therefore, although previous literature suggests that larger tumours may allow better radiologic detection and greater diagnostic confidence, this association was not demonstrated in the present cohort [13].

Study Limitations:

The retrospective design and single-institution nature of the study introduce the potential for selection bias; control over imaging protocols and data completeness is limited. The low percentage of ILC cases further reduces statistical power and prevents reliable subtype-based comparisons. Also, incomplete documentation in some ultrasound reports resulted in missing data for certain imaging variables. In addition, image interpretation was based on consensus review rather than independent blinded readings, so interobserver agreement using Kappa statistics was not calculated. Additionally, the lack of routine MRI correlation limits the extent of evaluation, especially given MRI's greater accuracy in depicting the pathological extent of ILC compared with conventional imaging [14].

5. Conclusions

This study describes the mammographic and ultrasound appearances of histologically confirmed IDC and ILC in a single institutional cohort from Oman. Architectural distortion, asymmetry, and other subtle imaging features were observed in the cohort. However, because only four ILC cases were included, these observations should be interpreted descriptively and in the context of existing literature. Mammography and ultrasound were used together to characterize the lesions in this cohort; however, the study was not designed to determine the incremental diagnostic value of either modality. Larger, multi-institutional studies incorporating advanced imaging modalities are needed to validate and expand these findings.

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Abbreviations

The following abbreviations are used in this manuscript:

IDC	Invasive ductal carcinoma
ILC	Invasive lobular carcinoma
BI-RADS	Breast Imaging Reporting and Data System
MRI	Magnetic resonance imaging
IQR	Interquartile range
SPSS	Statistical Package for the Social Sciences
IBM	International Business Machines
US	Ultrasound

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