

Radiological Features of Breast Cancer in Women Aged 40 Years and Younger: A Retrospective Study from a Tertiary Hospital in Saudi Arabia

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Abstract

Background: Breast cancer diagnosed in women aged 40 years or younger is rare on a global scale but shows a notable clustering in Saudi Arabia. This younger cohort frequently has denser glandular tissue and more aggressive cancer biology, which complicates early detection for imaging specialists.

Objective: Our aim was to characterize the imaging features of breast cancer in young Saudi women and to relate these findings to underlying tumor subtypes within a tertiary hospital environment.

Methods: We conducted a retrospective review of imaging and corresponding histopathology from 150 women aged 40 years or younger who received a breast cancer diagnosis at our institution between 2019 and 2024. Data from mammography, ultrasound, and MRI studies were examined in conjunction with tumor subtype classification.

Results: The average age at diagnosis was 35.2 years (± 4.1); 72% of the cohort was staged at II or III. Dense breast tissue (ACR classification C or D) was present in 82% of any mammogram performed. Ultrasound typically displayed irregular hypoechoic lesions accompanied by posterior acoustic shadowing (69% of cases), while MRI demonstrated fast initial enhancement followed by washout kinetics in 62% of tumors. The subtypes identified were Luminal A (22%), Luminal B (28%), HER2-positive (24%), and triple-negative (26%).

Conclusion: Breast cancer affects young women in Saudi Arabia at an alarming prevalence of advanced stages and aggressive histological variants. The prevalence of radiologically dense breast tissue in this population diminishes mammographic sensitivity, making ultrasound the preferred first-line imaging technique and underscoring the utility of MRI for diagnostic resolution in complicated cases.

Keywords: breast cancer, young women, Saudi Arabia, ultrasound, MRI, dense breast tissue, aggressive tumor subtypes

INTRODUCTION

Breast cancer remains the most frequent malignancy among women worldwide, presenting an especially pressing challenge when it strikes those under 40. In Saudi Arabia, the proportion of cases diagnosed before this age is notably higher than in many Western countries, prompting a closer examination of tumor biology, inherited risk factors, and the alignment of imaging protocols with the needs of this younger cohort.

These younger patients present a distinctive diagnostic landscape. The combination of dense breast parenchyma and the potential for more aggressive tumor biology can mask lesions on conventional mammography and accelerate disease progress. Clinicians and radiologists, therefore, face a pressing need to tailor imaging pathways; balancing the use of supplemental ultrasound, the specificity of MRI, and the judicious timing of mammography is essential to minimize delays and initiate effective treatment.

Tertiary care hospitals in Saudi Arabia operate at a critical juncture in breast cancer management. These institutions routinely manage the most advanced presentations, including women who arrive with late-stage disease. Although the existing literature catalogues the imaging characteristics of breast cancer among younger women, studies emanating from Saudi Arabia are sparse, and few address the intersection of radiological findings, biological behavior, and stage at the time of diagnosis. Filling this gap is vital; a refined understanding of the imaging phenotype could facilitate earlier identification, inform tailored screening protocols, and enhance the trajectory of care.

To this end, the present investigation focuses on the radiological characteristics of breast cancer among women aged 40 years and younger who are treated at a tertiary care facility in Saudi Arabia. This inquiry seeks to

document prevailing imaging patterns, recognize routine interpretive challenges, and delineate specific opportunities for enhancing diagnostic accuracy.

LITERATURE REVIEW

Breast cancer in young women globally represents around 5–7% of totals, yet Saudi Arabia's figures stand apart. Regional analyses reveal that 20–30% of breast cancer cases in the Kingdom are diagnosed in women under 40, with the precise proportion varying between cities and institutions (Omer et al., 2024). The relatively high prevalence in this age bracket is generally ascribed to inherited susceptibility, altered reproductive patterns, and, plausibly, specific environmental exposures.

Diagnostic imaging reveals certain challenges. Young women typically manifest dense parenchyma that diminishes mammographic sensitivity (Alhaidary et al., 2024). Consequently, breast ultrasound has gained status as the primary modality for symptomatic patients under 40. While mammography remains ancillary, magnetic resonance imaging is reserved for individuals designated as high risk or when unclear findings on established imaging call for further clarification. Despite evolving protocols, many young women still arrive with advanced disease, a fact that underscores the endurance of pernicious referral and diagnostic delays (Trabulsi, 2024).

Histopathological observation corroborates the clinical concern. Tumors in this age group are disproportionately of the higher-risk phenotypes, especially triple-negative and HER2-positive categories (Albasri et al., 2021). These variants commonly exhibit sonographic signatures of markedly hypoechoic foci with posterior shadowing, as well as kinetic patterns of swift enhancement on dynamic contrast-enhanced MRI, generating a conspicuous contrast with the more indolent tumors generally affecting older demographics.

Research from Saudi Arabia on this subject is still limited, yet the findings published so far offer crucial perspectives. Makanjuola et al. (2014) identified an unexpected frequency of breast cancer among women younger than 30, highlighting the imperative for heightened awareness and more rigorous diagnostic protocols in this demographic. Following this, Alhaidary et al. (2022) examined uncommon and particularly aggressive histological types, reinforcing the necessity of integrating imaging results with histopathological findings in younger patients. Collectively, the body of evidence reveals three recurring patterns:

- An onset of breast carcinoma in Saudi women that precedes global averages.
- Diagnostic hurdles linked to dense glandular tissue and atypical clinical presentations.
- A biological profile characterized by aggressive tumor behavior, necessitating swift and accurate imaging-guided assessment.

These patterns underscore an urgent requirement for an evidence oeuvre that specifically informs radiological practice for young Saudi patients—a need this study intends to fulfill.

METHODOLOGY

Study Design and Setting

This was a retrospective observational study carried out within the Radiology Department of a tertiary referral hospital located in Riyadh, Saudi Arabia. The centre functions as a primary oncology referral centre, attracting patients sent from both primary and tertiary healthcare facilities throughout the entire region.

Study Population

We examined the clinical files of female patients aged 40 years or younger whom we diagnosed with breast cancer from January 2019 through December 2024. Every included patient had previously undergone at least one imaging examination—either mammography, ultrasound, or magnetic resonance imaging—at our centre, preceding the definitive pathology confirmation.

Inclusion Criteria

- Female patients aged 40 years or younger at diagnosis.
- Diagnosis of breast cancer confirmed by histopathology.
- Evidence of pre-treatment imaging obtained at our hospital.

Exclusion Criteria

- Imaging records considered incomplete.
- History of breast surgery at any time prior or known recurrent disease at the point of presentation.
- Imaging carried out entirely at external institutions without sufficient records.

Data Collection

We obtained patient-level data from the hospital's Picture Archiving and Communication System and the integrated electronic medical records. The variables recorded included:

- Demographic variables: age at diagnosis and any known family history of breast cancer.
- Clinical variables: presenting symptoms and stage of disease at the time of diagnosis.
- Radiological characteristics:
 - Mammography findings, including breast density, the morphology of lesions, the characteristics of margins, and patterns of calcification.
 - Ultrasound variables included echotexture, posterior acoustic features, and vascularity assessment.
 - MRI, when available, reported enhancement patterns, lesion dimensions, and associated kinetic curves.
 - Histopathological corroboration provided tumor subtype, histological grade, and receptor status.

Imaging Interpretation

Two fellowship-trained breast radiologists with over eight years of independent experience reviewed all studies separately. Any discordant findings were rectified by joint review. Lesions were categorized following the BI-RADS lexicon.

Statistical Analysis

Analysis utilized SPSS version 31. Continuous data are expressed as means \pm standard deviation, and categorical data as counts and percentages. Relationships between imaging features and tumor subtypes were evaluated by Chi-square or Fisher's exact test, as warranted. A p-value of <0.05 indicated statistical significance.

Ethical Considerations

Ethics committee approval for the study was obtained. Informed consent was exempted in accordance with the retrospective study design and the use of anonymized data. All procedures adhered to the Declaration of Helsinki and to prevailing national research ethics statutes.

RESULTS

Demographic and Clinical Characteristics

The analysis comprised 150 women aged 40 years or younger. The average age at diagnosis was 35.2 years (standard deviation 4.1 years; range 24 to 40 years). Family history of breast cancer was noted in 28% of participants (n = 42). The principal presenting symptom was a palpable breast lump, reported by 74% of women. At diagnosis, most tumors were classified as Stage II (40%) or Stage III (32%); Stage I tumors comprised 18%, and Stage IV tumors 10%

Table 1. Demographic and clinical characteristics of study population

Variable	Value
Mean age at diagnosis (years)	35.2 \pm 4.1
Age range (years)	24-40
Family history of breast cancer	28% (n = 42)
Most common presenting symptom	Palpable lump (74%)
Stage at diagnosis - Stage I	18% (n = 27)
Stage II	40% (n = 60)
Stage III	32% (n = 48)
Stage IV	10% (n = 15)

Imaging Features

A total of 108 patients (72%) underwent mammography, revealing high breast density (ACR C/D) in 82%, which frequently reduced the clarity of lesions. Pleomorphic calcifications were identified in 21% of the studies. Ultrasound imaging was performed in every patient, typically showing irregular hypoechoic lesions accompanied by posterior acoustic shadowing (69%); Doppler studies indicated increased vascularity in 58% of the cases. MRI was carried out in 68 patients (45%); it often showed rapid initial contrast uptake accompanied by washout kinetics (62%) and identified multifocal disease in 19%.

Table 2. Imaging features by modality

Imaging Modality	Most Common Finding	Notable Additional Findings
Mammography	High breast density (ACR C/D) in 82% cases	Pleomorphic calcifications (21%)
Ultrasound	Irregular hypoechoic mass with posterior shadowing (69%)	Increased vascularity on Doppler (58%)
MRI	Rapid initial enhancement with washout kinetics (62%)	Multifocal disease in 19%

Tumor Subtypes

The histopathological evaluation showed an overall even partition between more and less aggressive tumor characteristics. Among the cohort, 26% of patients exhibited triple-negative breast cancer, 24% presented with HER2-positive tumors, 28% were classified as Luminal B, and 22% as Luminal A.

Table 3. Tumor subtype distribution

Tumor Subtype	Frequency (%)
Luminal A	22
Luminal B	28
HER2-positive	24
Triple-negative	26

DISCUSSION

This investigation delineates key imaging and histologic features of breast cancer in Saudi women aged 40 and younger, a demographic that accounts for a strikingly larger fraction of cases here than in most other countries. Our results corroborate the warnings of earlier Saudi studies (Omer et al., 2024; Trabulsi, 2024) that malignancies in this younger cohort tend to emerge at more advanced stages and exhibit aggressive biology.

Age at Diagnosis and Disease Extent Our average age at diagnosis of 35.2 years aligns with prior national reports, which indicate a decade earlier onset than in much of the West. Over 70% of participants were classified at Stage II or above, reinforcing earlier conclusions that gaps in timely detection endure. Mammograms revealed dense breast tissue in more than 80% of cases, likely obscuring small lesions and prolonging time to diagnosis. This finding validates the already endorsed recommendation, both domestically and internationally, to rely on ultrasound as the preferred imaging method in symptomatic women younger than 40.

Aggressive Tumor Biology

The prevalence of triple-negative (26%) and HER2-positive (24%) tumors in this study reinforces observations by Albasri et al., 2021, indicating that the aggressive breast cancer phenotype is particularly pronounced among younger Saudi women. These subgroups shape both survival outcomes and, importantly, yield characteristic imaging features—irregular hypoechoic regions on ultrasound paired with early contrast washout on MRI—that, when considered alongside clinical presentation, can flag the disease at an earlier clinical stage.

Imaging Implications

Although mammography remains the standard screening modality, its efficacy in this cohort was limited by the high breast density common among younger women. In contrast, ultrasound consistently facilitated both detection and characterization of the lesions, with Doppler imaging providing vital data on perfusion. MRI, utilized in fewer than half the patients, nonetheless proved decisive in revealing multifocality and refining the surgical margin, directing precision in operative strategy. In light of these findings, enhancing access to breast MRI for this at-risk and often complex group could unmask additional, otherwise subtle malignancies, thereby informing more effective therapeutic approaches.

Clinical and Public Health Considerations

The trend of late presentation underscores an urgent need for heightened awareness and more focused screening of younger women at elevated risk. Although the debate on universal screening before age 40 persists, our data reinforce the value of customizing screening protocols based on individual risk, especially in those with familial or genetic vulnerabilities. Public health campaigns that educate on self-examination, encourage the prompt disclosure of concerning symptoms, and promote accessible diagnostic pathways could facilitate earlier-stage detection.

Limitations

The retrospective nature of our analysis and its confinement to a single center constrain its applicability to the broader population. Moreover, the inconsistency in MRI use may have led to an undercount of multifocal lesions. Still, mandatory histopathological verification of all malignancies fortifies the integrity of our imaging and histological comparisons.

Future Directions

Subsequent investigations should track long-term outcomes for young Saudi women with breast cancer, merging imaging data, pathological findings, and treatment course. Collaborative, multi-center studies could furnish a national data framework capable of shaping evidence-based, age-specific screening and diagnostic protocols.

CONCLUSION

In Saudi women 40 years and younger, breast cancer frequently appears at later stages and features more aggressive tumor biology. The dense breast tissue typical in this age group decreases mammogram diagnostic power, positioning ultrasound as the primary imaging modality; MRI is reserved for complex or elevated-risk presentations. Prompt identification of imaging features, alongside outreach and tailored screening initiatives, has the potential to enhance early diagnosis and ultimately patient survival in this vulnerable cohort.

REFERENCES

1. Trabulsi N. Radiological features in young patients with early and locally advanced breast cancer: A retrospective study at a tertiary Saudi hospital. *Saudi Surg J.* 2024;42(7). Available from: https://journals.lww.com/sasj/fulltext/2024/07000/radiological_features_in_young_patients_with_early.2.aspx?context=latestarticles
2. Albasri AM. Clinicopathological characteristics of young versus older patients with breast cancer: A retrospective comparative study from the Madinah region of Saudi Arabia. *Saudi Med J.* 2021;42(7):769–774. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9195524/>
3. Alhaidary AA, Al-Qudimat AR, Arabi H. Imaging patterns in breast cancer for women under 40 years: a descriptive cohort study. *Egypt J Radiol Nucl Med.* 2024;55(69). Available from: <https://link.springer.com/article/10.1007/s44197-023-00169-2>
4. Makanjuola D, Alkushi A, Alzaid M, Abukhair O. Breast cancer in women younger than 30 years: prevalence rate and imaging findings in a symptomatic population. *Pan Afr Med J.* 2014;19:35. Available from: <https://www.ajol.info/index.php/pamj/article/view/134500>
5. Omer AAA, Dayel SAB, Hummedi ASA. The epidemiological and clinicopathological features of breast cancer in Riyadh, Saudi Arabia. *J Egypt Natl Canc Inst.* 2024;36(1):14. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC11115392/>
6. Alhaidary AA, Arabi H, Elessawy M. Metaplastic breast carcinoma: an overview of the radio-pathologic features in a retrospective cohort tertiary hospital. *Egypt J Radiol Nucl Med.* 2022;53:62. Available from: <https://link.springer.com/content/pdf/10.1186/s43055-022-00761-9.pdf>
7. AlShamlan NA, AlOmar RS. Characteristics of breast masses of female patients referred for diagnostic breast ultrasound from a Saudi primary health care setting. *Int J Gen Med.* 2021;14:3783–3790. Available from: <https://www.tandfonline.com/doi/pdf/10.2147/IJGM.S298389>
8. Rudat V, El-Sweilmeen H, Fadel E. Age of 40 years or younger is an independent risk factor for locoregional failure in early breast cancer: A single-institutional analysis in Saudi Arabia. *ISRN Oncol.* 2012;2012:370385. Available from: <https://onlinelibrary.wiley.com/doi/pdf/10.1155/2012/370385>