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ORIGINAL ARTICLE

Molecular Profiling and Clinical Characteristics of Breast Cancer in the Asir Region: a Retrospective Analysis

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SUMMARY

Background: **Breast cancer is a major health issue in the Asir region of Saudi Arabia and is characterized by diverse molecular subtypes and varying clinicopathological features. This study focuses on analyzing the molecular subtypes of breast cancer, investigating associated clinical and pathological factors, and assessing the role of immunohistochemistry (IHC) in subtype classification.**
Methods: **A retrospective analysis was conducted on 385 patients with breast cancer from Asir Central Hospital. Clinicopathological data, including tumor size and molecular subtype distribution, were collected. IHC was performed to determine the expression of the estrogen receptors (ER), progesterone receptors (PR), and HER2.**
Results: **The average patient age was 44.69 years (standard deviation [SD], 15.983), ranging from 4 to 93 years. The majority of cases were in women aged 31 - 60 years (60%), with fewer cases in individuals aged > 60 years (17.4%). Invasive ductal carcinoma (IDC) was the most common histological type (37.9%), followed by fibroadenoma (35.8%) and other benign tumors (14.5%). Most tumors were > 2 cm in size (2.6%), indicating a delayed diagnosis. Luminal A was the most frequent molecular subtype (67.3%), followed by triple-negative (19.23%) and luminal B (13.46%). Strong positivity for PR, ER, and HER2 was predominantly observed in IDC cases, with luminal A subtype showing the highest positivity rate.**
Conclusions: **This study emphasizes the predominance of the IDC and luminal A subtypes in the Asir region, underscoring the importance of tailored treatment strategies based on molecular profiles. These findings highlight the need for improved early detection and screening programs to address delayed diagnosis of breast cancer. Enhanced awareness and education about breast cancer, coupled with better access to screening, are crucial for improving patient outcomes in this region. IHC analysis has proven to be a reliable tool for identifying breast cancer subtypes and aiding precise treatment decisions.**
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INTRODUCTION

Breast cancer is a significant global health challenge that remains one of the leading causes of cancer-related deaths among women worldwide [1,2]. It is the most

frequently diagnosed cancer in women, accounting for nearly 30% of all cancers [3,4]. While the disease predominantly affects women aged 50 years and older, an increasing incidence has been observed in younger women, often in their 30's and 40's [5,6]. Early detection and advances in treatment have improved survival rates. However, breast cancer still poses a substantial health burden, particularly in low- and middle-income countries where access to timely healthcare services is limited. The biological complexity of breast cancer is reflected in its classification into multiple histological and molecular subtypes, each with distinct characteristics that influence disease progression, treatment response, and overall prognosis [7,8].

Breast cancer classification has evolved from histopathological evaluation to advanced molecular profiling [9]. Molecular subtyping divides breast cancer into five major subtypes: luminal A, luminal B, HER2-enriched, basal-like (triple-negative), and normal-like [10]. This classification is based on the expression of key molecular markers, including the estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2). These subtypes are crucial in guiding treatment strategies because they exhibit varied responses to hormonal, targeted, and chemotherapeutic treatments [11]. For instance, luminal A and B subtypes are hormone receptor-positive and typically respond to endocrine therapies, such as tamoxifen, whereas HER2-enriched subtypes are managed with HER2-targeted therapies, such as trastuzumab. Triple-negative breast cancer (TNBC), which lacks expression of ER, PR, and HER2, often requires more aggressive chemotherapy due to the absence of targeted treatment options [12]. Immunohistochemistry (IHC) is a widely used and cost-effective method for determining breast cancer subtypes based on ER, PR, and HER2 expression. IHC is a practical alternative to gene expression analysis, which requires advanced molecular tools such as DNA microarrays [13,14]. The information obtained from IHC is essential for clinical decision-making as it allows the classification of breast cancer into subtypes that guide therapeutic interventions. The use of IHC in clinical practice has improved the personalization of breast cancer treatments, leading to better clinical outcomes and more targeted therapeutic approaches [15].

Globally, the distribution of breast cancer subtypes varies considerably across populations, ethnic groups, and geographic regions [16]. In western countries, the most prevalent subtype is luminal A associated with a better prognosis and lower risk of recurrence [17]. In contrast, Middle Eastern, African, and some Asian populations exhibit a higher prevalence of more aggressive subtypes such as HER2-enriched and triple-negative breast cancers. Several factors, including genetic predisposition, environmental influences, lifestyle habits, and access to healthcare are believed to have contributed to these differences. Understanding regional variations in breast cancer subtypes is critical for tailoring treatment protocols and improving disease management in specific populations [18].

In Saudi Arabia, breast cancer is the most commonly diagnosed cancer among women, accounting for nearly one-quarter of all cancers. Although the incidence of breast cancer in Saudi Arabia (29.6 per 100,000) is lower than the global rate (43.1 per 100,000), the disease is characterized by an earlier age of onset and a more aggressive clinical presentation [19,20]. The average age of diagnosis for Saudi women is 49 years, compared to 61 years in western countries. Additionally, breast cancer in Saudi Arabia is often detected at more advanced stages, with larger tumor sizes and a higher rate of lymph node involvement, which negatively affects the prognosis and survival outcomes. This late-stage presentation is attributed to factors such as limited public awareness, cultural barriers, and inadequate participation in routine screening programs [21,22].

Regional differences in the molecular subtypes of breast cancer have been well-documented. Research conducted in various parts of Saudi Arabia has shown unique patterns of molecular subtypes compared to western populations [23]. For instance, studies have reported a higher prevalence of HER2-positive and triple-negative breast cancer subtypes in Saudi Arabian women. This contrasts with the predominance of luminal A subtypes observed in western countries. These differences may be due to variations in genetic susceptibility, environmental risk factors, or socio-cultural influences. Identifying the molecular profile of breast cancer in Saudi Arabia is crucial for developing population-specific treatment protocols and public health strategies [24].

The Asir region, situated in southwestern Saudi Arabia, has a distinct demographic and genetic profile compared to other regions of the country [25]. However, limited data are available on the molecular subtypes of breast cancer in this region. Exploring the molecular landscape of breast cancer in Asir is essential for understanding its biological behavior, tailoring region-specific treatment strategies, and enhancing early detection. Because regional differences in breast cancer subtypes are evident in other parts of Saudi Arabia, it is critical to investigate the molecular characteristics of breast cancer in Asia to support the development of localized healthcare policies and screening programs [26,27].

This study assesses the distribution of the molecular subtypes of breast cancer in the Asir region of Saudi Arabia based on the expression of key biomarkers (ER, PR, and HER2) and to identify the most prevalent subtype. We also examined the correlation between these subtypes and clinicopathological factors, including age, gender, tumor size, diagnosis, SBR grade, and lymph node status. These findings provide valuable insights into the prevalence of breast cancer subtypes in this region and support the development of more effective region-specific treatment protocols. Furthermore, this study contributes to a broader understanding of breast cancer epidemiology in Saudi Arabia by assisting

healthcare providers in making evidence-based clinical decisions and improving patient outcomes.

MATERIALS AND METHODS

Study setting and design

This study was conducted at Asir Central Hospital, a major referral hospital in Abha, Saudi Arabia, which serves the Asir region and its surrounding areas. A retrospective observational study design was used to analyze patient data and tissue samples from the hospital's surgical pathology laboratory. This study focused on breast cancer cases diagnosed between 2022 and 2024.

Data collection

Patient data encompassing 385 breast cancer cases were extracted from the hospital's archival records. The collected data included demographic details (gender, nationality, and age at diagnosis), clinical information (tumor size, pathological subtype, lymph node status, and tumor grade), and IHC marker results for estrogen receptor (ER), progesterone receptor (PR), and HER2 status).

Histopathological and molecular analysis

For histopathological evaluation, the tumor size was recorded from pre-biopsy ultrasound reports or alternative imaging methods (mammography, CT, and MRI). If imaging data were unavailable, the tumor size was recorded from the surgical reports. Tumor grade was determined using the Elston-Ellis modification of the Scarff-Bloom-Richardson (SBR) system. Lymph node status was evaluated through imaging and histological examination of the axillary lymph nodes, using mastectomy and biopsy specimens. Breast cancer molecular subtypes were categorized based on ER, PR, and HER2 expression as luminal A, luminal B, HER2-enriched, and triple-negative.

Processing and staining

A subset of 100 tissue samples was randomly selected to validate the histopathological data. Formalin-fixed paraffin-embedded (FFPE) tissue blocks were sectioned at 4 µm thickness, and sections were stained using hematoxylin and eosin (H&E) to evaluate tissue morphology. The tissue sections were deparaffinized, rehydrated, and incubated with hematoxylin and eosin for nuclear and cytoplasmic staining. The sections were dehydrated, mounted, and examined under a microscope.

Sample processing and histological evaluation

A subset of 100 formalin-fixed paraffin-embedded (FFPE) breast cancer tissue blocks was randomly selected for histopathological validation. A rotary microtome (Leica RM2125 RTS, Germany) was used to cut each block into 4 µm sections. The sections were mounted on positively charged glass slides and dried overnight at 37°C. For hematoxylin and eosin (H&E) staining, slides were deparaffinized in xylene and rehydrated through a graded ethanol series. Hematoxylin was applied for nuclear staining, followed by eosin for cytoplasmic contrast. After dehydration and clearing, slides were cover slipped using a DPX mounting medium. Microscopic evaluation was performed by two independent pathologists to assess tissue architecture, tumor cellularity, and morphological features including mitotic count, nuclear pleomorphism, and tubule formation. These parameters were used to assign tumor grade according to the Elston-Ellis modification of the Scarff-Bloom-Richardson (SBR) grading system.

IHC and scoring

IHC were performed to assess the ER, PR, and HER2 receptor status. IHC involved deparaffinization, antigen retrieval, blocking of endogenous peroxidases, and incubation with primary antibodies against ER, PR, and HER2. Secondary antibodies were applied, followed by chromogen visualization to form a brown precipitate at the antigen site. ER and PR were scored based on the Allred scoring system, with positivity defined as at least 1% nuclear staining in invasive malignant cells. HER2 scoring followed the College of American Pathologists (CAP) guidelines as follows: negative (0 or 1+), equivocal (2+), and positive (3+) [28,29].

Immunohistochemistry procedure and scoring

Immunohistochemical (IHC) analysis was performed on 4 µm FFPE sections the procedure included:

- ***Deparaffinization and rehydration:*** Slides were treated with xylene and graded ethanol.
- ***Antigen retrieval:*** Heat-induced epitope retrieval was conducted using citrate buffer (pH 6.0).
- ***Endogenous peroxidase blocking:*** Slides were incubated with 3% hydrogen peroxide for 10 minutes.
- ***Primary antibody incubation:*** Monoclonal antibodies targeting ER (clone SP1), PR (clone 1E2), and HER2 (clone 4B5) were applied for 45 minutes at room temperature.
- ***Detection and visualization:*** A biotin-free polymer detection system was used, followed by 3,3'-diaminobenzidine (DAB) chromogen to visualize antigen-antibody complexes.
- ***Counterstaining and mounting:*** Slides were counterstained with hematoxylin, dehydrated through a graded ethanol series, clearing in xylene and cover slipped using a DPX mounting medium

IHC scoring was performed as follows:

- ***ER and PR:*** Evaluated using the Allred scoring system, which combines proportion and intensity scores (range: 0 - 8). A score ≥ 3 (≥ 1% nuclear positivity) was considered positive.
- ***HER2:*** Scored according to the College of American Pathologists (CAP) and American Society of Clinical Oncology (ASCO) guidelines:
- 0 or 1+: Negative

- 2+: Equivocal (recommended for reflex testing via fluorescence in situ hybridization [FISH])
- 3+: Positive (uniform intense membrane staining in > 10% of tumor cells)

All IHC slides were reviewed independently by two pathologists. In cases of discordant interpretation, a third pathologist provided adjudication. Positive and negative controls were included in each staining batch to ensure assay reliability.

Statistical analysis

Data were analyzed using SPSS version 21.0. Descriptive statistics, including frequencies and percentages, were used to summarize the demographic and clinical parameters. Chi-squared tests were used to assess the associations between molecular subtypes and clinicopathological features (age, tumor grade, size, and lymph node status), with statistical significance set at $p < 0.05$.

Ethical considerations

The study adhered to the ethical guidelines for research involving human subjects. Patient confidentiality was ensured by anonymizing the records and assigning unique identification numbers to all data. Ethical approval was obtained from the Research Ethics Committee of the Deanship of Scientific Research at King Khalid University (ECM # 2021-5106).

RESULTS

Patient characteristics

This study analyzed a cohort of 385 patients diagnosed with BC between 2022 and 2024. The key pathological and clinical characteristics of the patients are summarized in Table 1.

Demographics

The demographic distribution revealed that most patients were female (98.4%), while only 1.6% were male. Additionally, 95.8% of the patients were Saudi nationals and 4.2% were non-Saudis. Age distribution showed that 60% of the patients were between 31 and 60 years old, followed by 22.6% aged ≤ 30 years, and 17.4% were over 60 years of age.

Surgical procedures

Six different surgical procedures were performed, with biopsy (35.1%) and true-cut biopsy (37.9%) being the most common procedures. Radical mastectomy was performed in 17.7% of cases, while mastectomy, lumpectomy, and vacuum-assisted biopsy accounted for < 3% of cases. A small number of patients did not undergo any recorded surgical procedures (0.8%) (Table 2).

Clinical diagnosis

The most common diagnosis was invasive ductal carcinoma (37.9%) followed by fibroadenoma (35.8%). Other diagnoses such as mixed invasive ductal and lobular carcinoma, invasive lobular carcinoma, and other benign breast tumors were less common. A small percentage (2.6%) of patients had no recorded diagnoses.

Lymph node status

Data on lymph node status were available for 100% all patients. Lymph node status was not recorded in 80.3% of cases, 11.4% had positive lymph node involvement, and 8.3% had negative lymph node status.

Tumor characteristics

Tumor size data were mostly unavailable (95.8%); however, among the few cases with recorded sizes, 1% had tumors ≤ 2 cm, 2.6% had tumors between 2.1 - 5 cm, and 0.5% had tumors larger than 5 cm. The majority of patients had no recorded SBR grade, but Grade II tumors were the most common among cases with recorded grades.

Immunohistochemistry results

Immunohistochemical analysis of 359 breast tissue samples was performed to assess ER, PR, and HER2 expression (Figure 1). The results showed that 17.9% of the cases were strongly positive for ER, 13.2% were strongly positive for PR, and 7.3% were positive for HER2. A significant percentage of patients (75.8%) had no HER2 data available (Table 3).

Molecular subtypes

Based on the immunohistochemistry results, the breast cancer cases were classified into the following molecular subtypes: luminal A (67.3%), luminal B (13.5%), and triple-negative (19.2%). Luminal A was the most prevalent subtype, with an average age of 56 years, luminal B had an average age of 50 years, and triple-negative patients had an average age of 52 years (Table 4).

Distribution of pathological and histopathological characteristics by age

The distribution of pathological and histopathological characteristics across different age groups is shown (Table 5). The p-values in Table 5 provide statistical evidence about the relationship between age groups (< 30, 31 - 60, and > 60) and various pathological and histopathological characteristics, including Diagnosis, Lymph Node Status, Procedure Type, and SBR Grade. Each p-value reflects the probability that the observed differences in these characteristics across the age groups could have occurred by chance. In this case, all p-values are less than 0.05 (specifically, 0.001), suggesting that the differences observed are statistically significant and not likely due to random variation. This indicates that age plays a significant role in the distribution of these characteristics. For example, invasive ductal carcinoma (IDC) is more prevalent in the older age groups (31 - 60 and 60+), while fibroadenoma, a benign tumor, is predominantly found in younger patients (less than 30). Similarly, differences in lymph node status (whether lymph nodes are free, positive, or none) and procedure

Table 1. Distribution of patient characteristics.

Demographic Data		No.	%
Gender	male	6	1.6
	female	379	98.4
Nationality	Saudi	369	95.8
	non-Saudi	16	4.2
Age group (years)	< 30	87	22.6
	31 - 60	231	60.0
	> 60	67	17.4
Diagnosis	invasive ductal carcinoma	146	37.9
	ductal carcinoma in-situ (DCIS)	11	2.9
	invasive lobular carcinoma	4	1.0
	fibroadenoma	138	35.8
	none	10	2.6
	other kind of benign breast tumor	56	14.5
	other kind of breast carcinoma	17	4.4
	mixed invasive ductal and lobular carcinoma	3	0.8
Lymph node status	none	309	80.3
	positive	44	11.4
	free	32	8.3
Mass Size	none	369	95.8
	less - 2 cm	4	1.0
	2.1 - 5 cm	10	2.6
	more than 5 cm	2	0.5
Procedure	biopsy	135	35.1
	true-cut	146	37.9
	radical mastectomy	68	17.7
	mastectomy	11	2.9
	lumpectomy	10	2.6
	vacuum assisted biopsy	12	3.1
	none	3	0.8
Immunohistochemistry (ER)	strong positive	69	17.9
	moderate positive	20	5.2
	weak positive	8	2.1
	negative	42	10.9
	none	246	63.9
Immunohistochemistry (PR)	strong positive	51	13.2
	moderate positive	23	6.0
	weak positive	8	2.1
	negative	45	11.7
	none	258	67.0
Immunohistochemistry (HER2)	positive	28	7.3
	negative	57	14.8
	equivocal	8	2.1
	none	292	75.8
SBR Grade	grade I	10	2.6
	grade II	49	12.7
	grade III	14	3.6
	none	312	81.0

Table 2. Surgical procedures.

Procedure	Frequency (N)	Percentage (%)
Biopsy	135	35.1
True-cut biopsy	146	37.9
Radical mastectomy	68	17.7
Mastectomy	11	2.9
Lumpectomy	10	2.6
Vacuum-assisted biopsy	12	3.1
No procedure	3	0.8

Table 3. Immunohistochemistry results.

Marker	Strong positive (%)	Moderate positive (%)	Weak positive (%)	Negative (%)	No data (%)
ER	17.9	5.2	2.1	10.9	63.9
PR	13.2	6.0	2.1	11.7	67.0
HER2	7.3	-	-	14.8	75.8

Table 4. Molecular subtypes of breast cancer.

Molecular Type	Average age	Total cases	Percentage (%)
Luminal A	56	70	67.3
Luminal B	50	14	13.5
Triple negative	52	20	19.2

types (such as biopsy, mastectomy, etc.) also show significant variation across age groups.

Fibroadenoma was the most common diagnosis in the youngest age group (≤ 30 years). The 31 - 60 years age group showed the highest prevalence of invasive ductal carcinoma. Lymph node status and SBR grades varied significantly by age, with the 31 - 60 years group having the highest frequency of positive lymph node status and Grade II tumors.

Diagnosis:

- Invasive Ductal Carcinoma (IDC): A type of breast cancer that starts in the milk ducts and spreads to surrounding tissue.
- Ductal Carcinoma in Situ (DCIS): A non-invasive cancer confined to the ducts.
- Invasive Lobular Carcinoma: Cancer that begins in the milk-producing lobules and spreads to surrounding tissue.
- Fibroadenoma: A benign (non-cancerous) tumor.
- None: No diagnosis or pathological condition.
- Other benign breast tumor: Other types of non-cancerous breast tumors.
- Other breast carcinoma: Other types of invasive breast cancer.
- Mixed invasive ductal and lobular carcinoma: A combination of IDC and invasive lobular carcinoma.

Lymph node status:

- None: No lymph node involvement.
- Positive: Lymph nodes show cancer spread.
- Free: Lymph nodes are clear of cancer, part of staging.

Procedure:

- Biopsy: A procedure to remove tissue for testing.
- True cut: A needle biopsy to remove a tissue sample.
- Radical Mastectomy: Removal of the breast and surrounding tissues.
- Mastectomy: Removal of the breast.

Table 5. Distribution of pathological and histopathological characteristics by age.

Pathological and histopathological characteristics		Age groups (years)			Total	p-value
		< 30	31 - 60	> 60		
Diagnosis	invasive ductal carcinoma	2	101	43	146	0.001
	ductal carcinoma in-situ (DCIS)	0	7	4	11	
	invasive lobular carcinoma	0	3	1	4	
	fibroadenoma	69	64	5	138	
	none	2	6	2	10	
	other kind of benign breast tumor	13	38	5	56	
	other kind of breast carcinoma	1	10	6	17	
	mixed invasive ductal and lobular carcinoma	0	2	1	3	
Lymph node status	none	87	180	42	309	0.001
	positive	0	31	13	44	
	free	0	20	12	32	
Procedure	biopsy	66	62	7	135	0.001
	true cut	12	103	31	146	
	radical mastectomy	0	47	21	68	
	mastectomy	0	6	5	11	
	lumpectomy	7	3	0	10	
	vacuum assisted biopsy	0	9	3	12	
	none	2	1	0	3	
SBR Grade	grade I	0	7	3	10	0.001
	grade II	0	35	14	49	
	grade III	0	10	4	14	
	none	87	179	46	312	

- Lumpectomy: Removal of the tumor only, preserving most of the breast.
- Vacuum assisted biopsy: A minimally invasive biopsy using suction.
- None: No procedure was performed.

SBR grade:

- Grade I: Low-grade, slower-growing tumor.
- Grade II: Moderate grade.
- Grade III: High-grade, aggressive tumor.
- None: No grade assigned or unavailable.

DISCUSSION

The primary objective of this study was to analyze the distribution of different molecular subtypes of breast cancer in the Asian region of Saudi Arabia, with a focus on the expression of various biomarkers. The study included 385 patients with breast cancer from Asir Central Hospital. Data on clinicopathological and histopathological characteristics were collected and examined. The mean age of the patients was 44.69 years (SD = 15.98), ranging from 4 to 93 years. The mean tumor size was 0.17 cm (SD = 1.04 cm), suggesting a predominance of early-stage cancers at diagnosis. This average age was consistent with a national cancer incidence report for Saudi Arabia [30]. Most breast cancer cases were observed in women (98.4%), which is consistent with the global trends. Additionally, the majority of patients (60%) were age group 31 - 60 years, whereas 17.4% were aged > 60 years. A previous study reported a high prevalence of breast cancer in women aged < 50 years [31,32]. A study conducted in Oman reported similar age-related trends [33]. In contrast, in the United States, 65.1% of breast cancer cases are diagnosed in women aged 55 years or older, according to the Surveillance, Epidemiology, and End Results Cancer Statistics Review [34]. The discrepancy in age distribution between Saudi Arabia and the United States may be attributed to differences in healthcare infrastructure, access to early detection programs, and socio-cultural factors [35].

Regarding tumor size, the study found that most cases (2.6%) had tumors between 2.1 - 5 cm, followed by those ≤ 2 cm (1%) and > 5 cm (0.5%). This distribution

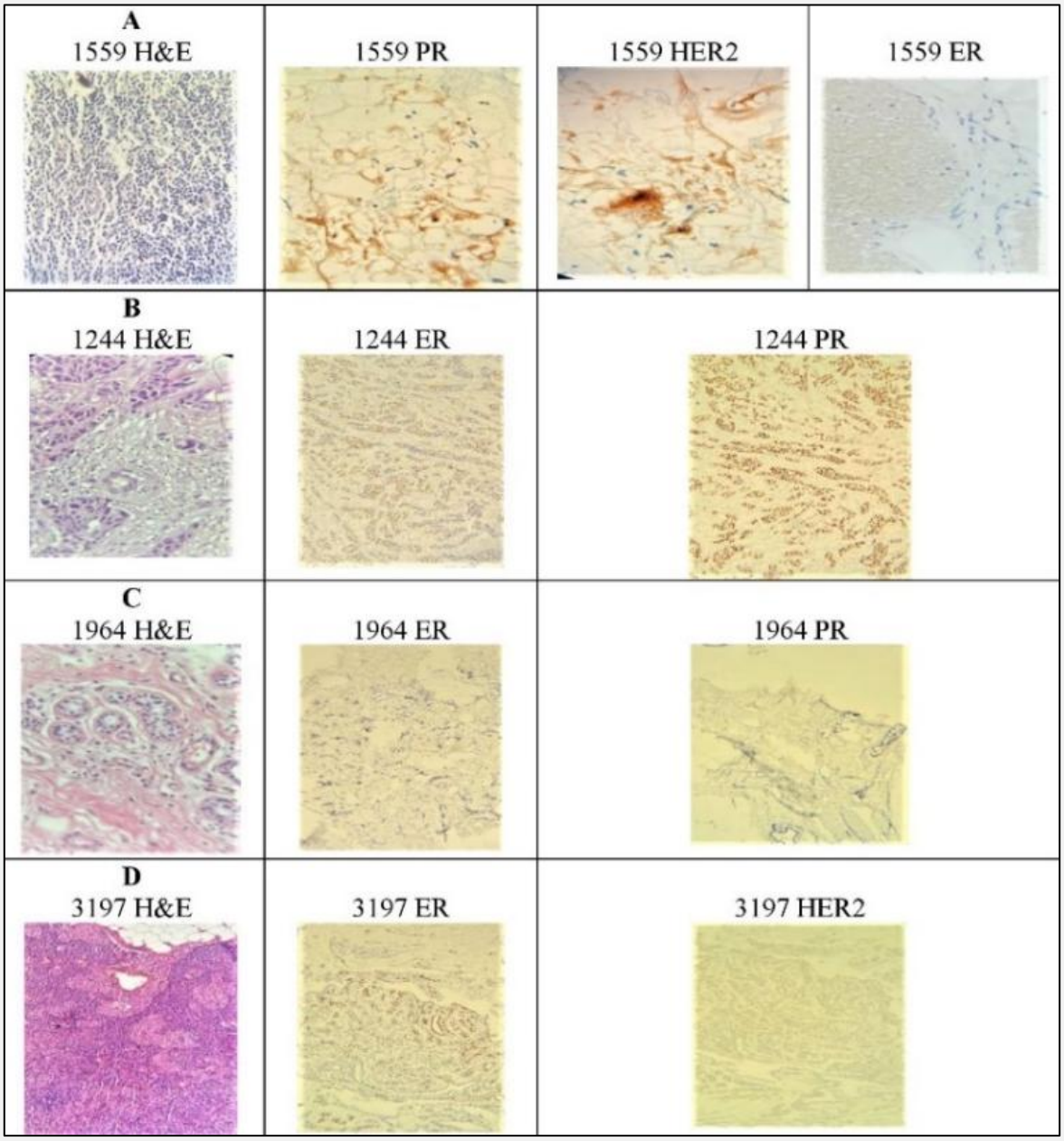

Figure 1. Microscopy slides with IHC results for selected cases of experimental study part.

suggests that many breast cancer cases are diagnosed at a relatively late stage in Saudi Arabia, potentially because of the lack of early detection and limited awareness. Similar observations have been reported for tumors measuring > 2 cm [36]. The delay in diagnosis can be attributed to insufficient public awareness of breast cancer symptoms and the absence of widespread screening programs. These factors underscore the urgent need for enhanced educational campaigns to raise awareness about the importance of early breast cancer detection through regular screening in Saudi Arabia.

The distribution of breast cancer types was another key aspect of this study. Invasive ductal carcinoma (IDC) emerged as the most prevalent type, accounting for 37.9% of cases, followed by fibroadenoma (35.8%) and other benign breast tumors (14.5%). Other types in-

cluded ductal carcinoma in situ (2.9%), invasive lobular carcinoma (1%), and mixed invasive ductal and lobular carcinomas (0.8%). Notably, 2.6% of the cases lacked a recorded diagnosis. Among the IDC cases, the majority were ER-positive, with strong ER positivity being the most common. This finding is consistent with existing literature, in which IDC is frequently associated with ER positivity. Additionally, a strong association was observed between IDC and HER2 positivity. PR positivity is also commonly observed in IDC [37]. These results are in line with findings from global studies, where IDC was frequently associated with hormone receptor positivity and HER2 overexpression. Such molecular characteristics are important in determining treatment strategies, as they influence the response to hormonal and targeted therapies.

When analyzing the molecular subtypes, luminal A was most common in the cohort (67.3%), followed by triple-negative (19.2%) and luminal B (13.5%). This distribution aligns with studies from both western and Asian countries, where luminal A was the prevalent subtype. These findings reflect the global trend that hormone receptor-positive and HER2-negative luminal A tumors have the best prognosis. Some studies have found no significant relationship between molecular subtypes and lymph node involvement [38,39].

However, some studies have suggested a strong association between HER2-positive tumors and lymph node metastasis, which is consistent with our finding that IDC cases, particularly those that are HER2-positive, show a greater frequency of lymph node involvement [40].

The analysis of age distribution among the different breast cancer types revealed that IDC was most common in the 31 - 60 age group (n = 101), followed by fibroadenoma (n = 64) in the same age group. For patients aged > 60 years, IDC remained the most frequent diagnosis (n = 43), whereas other tumor types accounted for fewer cases. In contrast, fibroadenomas were more prevalent in patients aged < 30 years (n = 69), followed by other benign tumors (n = 13). The higher frequency of IDC in patients aged 31 - 60 years aligns with findings from other studies, which also reported IDC as the predominant breast cancer type in this age group, typically accounting for over 80% of cases.

CONCLUSION

This study highlights the urgent need for improved early detection and awareness of breast cancer in the Asir region of Saudi Arabia. The high prevalence of IDC and dominance of the luminal A subtype underscore the importance of personalized treatment strategies based on hormonal receptor status of ER and PR and HER2 expression. Late-stage diagnoses, as evidenced by tumor sizes exceeding 2.1 cm in most patients, emphasize the need for expanded public health initiatives, regular screening programs, and awareness campaigns to promote early detection. IDC is the most prevalent type of breast cancer, followed by fibroadenoma and other benign tumors, whereas ductal carcinoma in situ, invasive lobular carcinoma, and mixed invasive ductal and lobular carcinoma are less common. Breast cancer was the most frequent cancer among individuals aged 31 - 60 years, with IDC and fibroadenoma being the most commonly diagnosed cancers. Immunohistochemistry analysis revealed strong positive expressions of ER, PR, and HER2, with luminal A being the most prevalent subtype, followed by triple-negative and luminal B. These findings emphasize the critical role of immunohistochemistry in breast cancer classification, supporting its use in guiding personalized treatment and improving patient outcomes.

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Institutional Review Board Statement:
The study was approved by the Research Ethics Committee of the Deanship of Scientific Research at King Khalid University (approval no. ECM # 2021-5106 dated on 20210415) and conducted in accordance with the Declaration of Helsinki.

Informed Consent Statement:
Given the retrospective nature of the study, informed consent from patients was waived.

Data Availability Statement:
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of Interest:
The authors declare no conflict of interest.

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