



Clinicopathological Characteristics, Molecular Subtypes, and Five-Year Survival Outcomes of Breast Cancer Among Pakistani Women: A Prospective Study from a Tertiary Care Hospital

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Abstract: Background: Breast cancer is the most widespread cancer in women across the globe and a significant health issue in Pakistan where its late detection and heterogeneous molecular phenotypes affect the survival benefit. The objective of the study was to assess clinicopathological features, molecular variation, meta-treatment, recurrence and five-year survival outcomes of breast cancer in Pakistani women. **Methods:** A prospective study was conducted at a tertiary care hospital in Lahore, Pakistan and 300 histopathologically confirmed female breast cancer patients were recruited by consecutive sampling. The demographic and pathology data such as age, TNM stage, receptor, (ER, PR, HER2), molecular subtype, treatment modality, recurrence, and 5 years survival were documented on systematic proforma. Status of the receptors was identified using immunohistochemistry, and molecular subtypes were determined. The SPSS version 25 was used to analyze the data. Continuous variables were used to have the mean with standard deviation and the categorical variables were presented as frequency and percentage. The Chi-square test was used to determine association between molecular subtype and survival with $p \leq 0.05$ statistically significant. **Results:** The age of the patients was 55.8 ± 14.6 years. The majority of the cases were Stage I (32.0%) and Stage IIA (29.3%) disease. ER, PR and HER2 were positive in 62.0%, 57.0% and 30.7% of the patients respectively. Luminal A was the commonest molecular subtype (39.3%). In total, there were 54.7% of patients who were alive at five years and 26.0% who died. Molecular subtype was significantly associated with survival ($\chi^2 = 18.6$, $p = 0.002$), with Luminal A and triple-negative subtype exhibiting the best and worst results, respectively. **Conclusion:** Molecular subtype and clinicopathological features play an important role in determining five-year survival rates among breast cancer patients, which underscores the need to ensure an early diagnosis, molecular classification and treatment of breast cancer and personalized treatment therapy among Pakistani women to enhance their survival.

Keywords: Breast Cancer; Molecular Subtypes; Prognosis; Recurrence; Survival Outcomes.

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INTRODUCTION

Breast cancer develops as a malignant tumor due to epithelial tissues of the breast, and is the most commonly diagnosed cancer in women worldwide, as it occurs in about one out of eight women throughout their lifetime.¹ The 2022 report published by the World Health Organization (WHO) states that breast cancer was the most common type of cancer that had been diagnosed in 157 out of the 185 countries for an estimated 670,000 deaths worldwide.² Almost every second it is diagnosed in women who are not subjected to any risk factors such as age and sex and in men it occurs with a frequency of 0.5-1%. In Pakistan, breast cancer is a major public health issue among the population since its prevalence rates and mortality rates are the highest in Asia.³ The warning reports issued by the national cancer awareness organizations show that almost one out of every nine women in Pakistan is at threat of being affected by breast cancer, and over 40,000 women are killed per year by the disease. An average age of breast cancer development in the Western countries is about 63 years, though, in the Asian populations, including Pakistani, the average age of breast cancer development is about 47.5 years.⁴

The burden and severity of the disease is shown by the data provided by main cancer centers in Pakistan. Breast cancer made a significant percentage of the female malignancies over a period of around three decades, making it the leading registered cancer among female. The increasing rate of breast cancer is further underscored by incidences seen globally with the need to improve diagnostic and management strategies to be effective, especially in the developing nations.⁵ There are a number of risk factors that have been identified that contributed to the development of breast cancer including the reproductive and hormonal factors which include; early menarche, late menopause, mature maternal age at the first birth, low parity, low breastfeeding, hormone therapy and oral contraceptives. Genetic mutations especially those of BRCA1 and BRCA2 are also very important in the development of the disease. Besides this, screening procedures like mammography have been proven to decrease the mortality associated with breast cancer by about 20% underlining the need to diagnose and act on breast cancer as soon as possible.⁶

Breast cancer is formed into invasive and non-invasive categories according to the histopathological features. The most common type of ductal carcinoma is invasive ductal, whereas invasive lobular carcinoma and other special histological forms are less prevalent. Ductal carcinoma in situ and lobular carcinoma in situ are non-invasive lesions that are believed to be key precursors of invasive disease.⁷ Moreover, breast cancer has shown a great deal of biological behavior heterogeneity, which is highly dependent on hormone receptor status and molecular classification as subtypes.

Estrogen receptor (ER), progesterone receptor (PR) and human epidermal growth factor receptor-2 (HER2) molecular classification of breast cancer has become a mandatory part in the next prognosis and treatment decision. The prevalent molecular types of breast cancer are Luminal A, Luminal B, HER2-enriched, and triple-negative breast cancer.⁸ Research has revealed that tumors containing HER2 are generally linked to high clinical malignancy, increased tumor size, lymph node infiltration, and unfavourable prognosis. Besides being noted to be associated with more aggressive disease progression and lower survival rates, triple-negative breast cancer, as it does not express ER, PR or HER2, is also a type of cancer that is reported to be linked to a more threatening course of the disease.⁹

Breast cancer is usually managed using a multimodal approach which comprises surgery, chemotherapy, radiotherapy, hormonal therapy and targeted therapy. The outcome of treatment and long-term survival is determined by various clinicopathological characteristics such as the age of the patient, the stage of tumor presentation, receptor status, the molecular subtype, the type of treatment, and the pattern of recurrence. Such factors are of critical importance in predicting the survival and understanding better patient management strategies.¹⁰ Although significant progress has been made in the management of breast cancer, there is a paucity of local data on the outcome of survival and clinicopathological features of breast cancer in Pakistani women. Such factors and their connection to the status of survival should be understood to better plan the treatment process and achieve better patient outcomes. Thus, the main aim of this study is to estimate clinicopathological features, molecular subtype, treatment options,

recurrence rate, and five-year survival rate in a Pakistani cohort of breast cancer patients.

METHODOLOGY

Study Setting and Design

It was a prospective cohort study conducted in order to evaluate clinical, pathological features and five-year outcomes with regards to survival in patients affected with carcinoma breast. The study was conducted in Gurkhi Hospital, Lahore, Pakistan, which is a tertiary care health facility, specialized in providing oncological services. It was carried out in a span of five years, upon receiving the consent of the Institutional Review Board (IRB) of hospital. All newly diagnosed cases of carcinoma breast presenting to the hospital during the study period were considered for enrollment. The sample of the study included 300 patients diagnosed with carcinoma breast. All the patients who were qualified and presented within the study were incorporated. Non-probability consecutive sampling technique was used to enroll eligible patients.

Inclusion Criteria

- Female patients diagnosed with carcinoma breast
- Histopathologically confirmed cases
- Patients presenting at Gurkhi Hospital during the study period
- Patients willing to participate in follow-up
- Women patients with carcinoma breast.
- Histopathologically confirmed cases
- Patients reported at the Gurkhi Hospital within the study period.
- Patients willing for follow-up.

Exclusion Criteria

- Male breast cancer patients
- Incomplete clinical records of patients.
- Lost to follow-up outcome assessment patients
- The patients who had a history of breast malignancy.

Data Collection Procedure

Prospective participation of eligible patients was done during diagnosis and then follow up. A structured proforma was used to gather the data. The variables recorded were as follows:

- Age at presentation
- Tumor stage on TNM basis.
- Hormone receptor (ER, PR) status.
- HER2 receptor status
- Molecular subtype classification
- Treatment modalities administered
- Duration of treatment
- Recurrence status
- Five-year survival status

Periodic assessment of the patients was conducted

through clinical judgment and medical records to determine survival rates and recurrence.

Definition of Receptor Status

The immunohistochemical (IHC) staining of formalin-fixed paraffin-embedded samples of tissues was used to determine estrogen receptor (ER) and progesterone receptor (PR) status. The ER-positive or PR-positive status of tumors was determined when the staining was observed in $\geq 1\%$ tumor cell nuclei. Those that had a $< 1\%$ staining were categorized as ER-negative or PR-negative. Status of HER2 receptor was established by means of IHC scoring:

- HER2 Negative: Score 0 or 1+.
- HER2 Equivocal: 2+ (affirmed by the FISH/ISH)
- HER2 Positive: Score 3+ or positive gene amplification.

Triple-negative cancer breast cancer was characterized as cancers that are negative to ER and PR and HER2 receptors.

TNM Classification

Staging of the tumor was done using the Tumor-Node- Metastasis (TNM) and classification system based on the American Joint Committee on Cancer (AJCC) Cancer Staging Manual, 8th edition. Clinical staging included:

- Tumor size (T) Possible involvement (N) in lymph node.
- Remote metastasis (M) is present.

A category of patients was in accordance with clinical stages.

Treatment Modalities

Treatment modalities included:

- Surgery
- Chemotherapy
- Hormonal therapy
- Targeted therapy (Trastuzumab in cases with HER2)

Neoadjuvant therapy was described as the treatment that is administered prior to surgery whereas adjuvant therapy was described as the treatment that is administered subsequent to surgery.

Outcome Measures

Primary Outcome:

Five-year survival status

Secondary Outcomes:

- Recurrence pattern (local or distant)
- Between molecular subtype and survival status.

Patients fell into the following categories:

- Alive
- Not Alive
- Too Early (less than 5 years follow-up)

Data Analysis

Statistical Package of Social Sciences (SPSS) version 25 was used to analyze the data. Continuous variables (mean age, Ki-67, mean duration of survival) were represented in form of mean and standard deviation (SD). Stage, receptor status, molecular subtype, treatment modality, survival status All categorical variables were expressed as frequencies and percentages. Assessment of association between molecular subtype and survival status was done through Chi-square test. A p-value of 0.05 or less was

used as a statistically significant value.

Ethical Considerations

The study was started after receiving ethical approval of the Institutional Review Board (IRB) of Gurkhi hospital, Lahore. The study was conducted in confidentiality of the patients and all data were utilized in the study.

RESULTS

A total of 300 patients diagnosed with carcinoma breast were included in the study. The clinicopathological features, treatment options, prognoses, and patients recurring were evaluated. The average age of the patients was 55.8 ± 14.6 years with a range of 28-82 years. The median Ki-67 proliferation index were 51.2 ± 22.8 , and the median survival was 5.6 ± 3.1 years as shown in table 1.

Table 1: Descriptive Statistics of Demographics Variables (n = 300)

Variable	Mean $\pm$ SD	Minimum	Maximum
Age (years)	55.8 ± 14.6	28	82
Ki-67 (%)	51.2 ± 22.8	5	85
Survival Years	5.6 ± 3.1	0	10

Footnote: Values are expressed as mean $\pm$ standard deviation (SD).

Table 2 demonstrated that a majority of the patients presented with Stage I disease (32.0%), then Stage IIA (29.3%) and Stage IIB (20.3%). It was found that 62.0% percent of patients had estrogen receptor and 57% had progesterone receptor. There were 30.7% positive patients who were identified to have receptor positive HER 2.

Table 2 Frequency Distribution of Clinical and Pathological Characteristics (n = 300)

Variable	Category	n	%
Cancer Stage	Stage I	96	32.0
	Stage IIA	88	29.3
	Stage IIB	61	20.3
	Stage IIIA	38	12.7
	Stage IIIB	17	5.7
ER Status	Positive	186	62.0
	Negative	114	38.0
PR Status	Positive	171	57.0
	Negative	129	43.0
HER2 Status	Positive	92	30.7
	Negative	208	69.3

Footnote: ER = Estrogen receptor; PR = Progesterone receptor; HER2 = Human epidermal growth factor receptor 2.

Table 3 shows that luminal A was the most prevalent 39.3%, followed by Luminal B (HER2-) (24.7%), Luminal B (HER2+) (13.7%). Triple-negative Breast cancer was 11.6%, and HER2-enriched tumor was found in 10.7% percent of patients.

Table 3 Distribution of Molecular Subtypes of Breast Cancer (n = 300)

Molecular Subtype	n	%
Luminal A	118	39.3
Luminal B (HER2-)	74	24.7
Luminal B (HER2+)	41	13.7
HER2-Enriched	32	10.7
Triple-Negative	35	11.6

Footnote: Subtypes classified using ER, PR, HER2, and Ki-67 expression.

Surgical therapy accompanied by hormonal therapy (37.3%), surgery with chemotherapy and hormonal therapy (32.3%) were the most frequently used modes of treatment as shown in table 4. Only chemotherapy was given to

21.0% and only chemotherapy with trastuzumab was used by 9.4% of the patients.

Table 4 Treatment Modalities Administered to Breast Cancer Patients (n = 300)

Treatment Modality	n	%
Surgery + Hormonal Therapy	112	37.3
Surgery + Chemotherapy + Hormonal Therapy	97	32.3
Chemotherapy Only	63	21.0
Chemotherapy + Trastuzumab	28	9.4

Footnote: Trastuzumab was administered only to HER2-positive patients.

Table 5 shows that as per the follow-up outcome, 54.7% of patients were alive and remaining 26.0% were not alive. Only 19.3% of patients had below five years of follow-up and were defined as too young to assess survival.

Table 5 Five-Year Survival Status Among Patients of Breast Cancer (n = 300)

Survival Status	n	%
Alive	164	54.7
Not Alive	78	26.0
Too Early (<5 years)	58	19.3

Footnote: Patients with follow-up less than five years were categorized as "Too Early".

Table 6 shows that molecular subtype and five years survival status were statistically related ($\chi^2 = 18.6$, $p = 0.002$). Luminal A patients had the highest survival rate (78.0%), and triple-negative breast cancer patients had the lowest survival rate (34.2%), which implies that this subtype has worse outcomes.

Table 6 Association Between Molecular Subtype and Five-Year Survival Among Breast Cancer Patients (n=300)

Molecular Subtype	Alive (%)	Not Alive (%)
Luminal A	78.0	22.0
Luminal B	61.5	38.5
HER2-Enriched	53.1	46.9
Triple-Negative	34.2	65.8

Footnote: Chi-square test applied; $\chi^2 = 18.6$, $p = 0.002$.

The majority of patients (73.7%), did not recur the disease in the course of the study. Recurrence was found locally in 13.7% and distant recurrence was found in 12.6% of the patients as shown in table 7.

Table 7 Pattern of Disease Recurrence in Breast Cancer Patients (n = 300)

Recurrence Type	n	%
None	221	73.7
Local	41	13.7
Distant	38	12.6

Footnote: Distant recurrence included metastasis to bone, lung, liver, or brain.

DISCUSSION

Breast cancer has been among the common disorders that result in cancer-related morbidity and mortality in women globally and is a current massive public health prospect in developing nations such as Pakistan. The current study conducted a clinicopathological assessment, molecular subtypes, treatment remedies, relapse progression, and 5-year survival rate of the breast cancer patients in a tertiary care centre. The mean age of the patients in the given study was 55.8 ± 14.6 years, this is slightly above the national averages in the past but it is still in the age bracket that is commonly affected by the condition; that is, middle-aged and old-aged women.¹¹ Previous researches that have been done in Pakistan have cited

the average of breast cancer diagnosis to be 45-50 years of age, which means that breast cancer among Pakistani women develops at relatively younger age than among the Western Population. This difference can be explained by genetic predisposition disparities, reproductive, lifestyle, and late of seeking medical services.¹²

Clinical staging at presentation is a major factor that can be used to know the treatment available and the survival. In the present research, patients appear at early stages, in which Stage I (32.0%) and IIA (29.3%) constitute the most prevalent ones. This observation implies a somewhat better positive result in early diagnosis than previously in the region where late diagnosis was a frequent occurrence.¹³ Reproductive

health infections are more apt to be treated and have a higher rate of survival because treatment is timely taken at an early stage. The hormone receptor status is one of the most important variables which shape the treatment planning and prognosis in patients with breast cancer. ER positivity was realized in 62.0%, PR positivity in 57.0% of patients in this research. The results can be compared to the outcomes of various other regional and international surveys which demonstrated the ER positivity of 60-70% and PR positivity of 50-65%.¹⁴ On the same note, HER2 positivity was reported in 30.7% of patients, which is consistent with the world-reported range of 15-30%. The clinical behavior of HER2-positive tumors is usually aggressive but, with targeted therapy to inhibit the HER2 e.g., use of trastuzumab, patient clinical behavior has greatly improved.¹⁵

Classification of molecular subtypes offers useful prognostic data and is at the centre of providing therapeutic directions. Luminal A subtype (39.3%) was the predominant in the current research, then Luminal B (HER2-), 24.7% and Luminal B (HER2+), 13.7%. Triple-negative cases were 11.6% and HER2 enriched subtype was 10.7% of the cases. These results are congruent with earlier reported distributions in South Asian populations, in which luminal subtypes represent the most common and triple-negative cancers represent about 10-20% of the cases.¹⁶ The modalities of treatment were different based on disease stage and receptor status. The most common treatment modality used in the present study was surgery with hormonal therapy (37.3%), surgery using chemotherapy and hormonal therapy (32.3%). The application of trastuzumab in patients with HER2 (9.4%) is also indicative of the implication of targeted therapy in breast cancer treatment practices today. The cornerstone of breast cancer treatment is multimodal therapy, and it has been demonstrated to increase survivability and lower recurrence rates.¹⁷ Five-year survival is a significant measure of outcome outcomes in patients with breast cancer in the long term. In the current study, the number of patients alive was 54.7% with 26.0% ends alive. Only a finite number of 19.3% patients followed up less than five years, which showed that more monitoring of the survival outcomes in the same group was required. The survival rates in the current study are in line with past published data concerning developing nations where such factors as stage of diagnosis, access to treatment and socioeconomic status contribute to survival rates.¹⁸ In the current study, it was statistically significant that molecular subtype was linked with five year survival status ($\chi^2 = 18.6$, $p = 0.002$). The best survival rate was in patients with Luminal A subtype (78.0%), which represents rather promising treatment prospects of hormone receptor-positive tumors. Conversely, triple-negative breast cancer patients survived at the lowest rate (34.2%),

portraying the aggressive behavior and few target treatment alternatives of this subtype.¹⁹ The same results are cited in various studies in other countries, which prove that triple-negative breast cancer is characterized by increased recurrence rates and means to die sooner. Recurrence of disease is a fault that still plays vital role in prognosis in the long run. In the present study, 73.7% of the patients were not expected to develop recurrence, 13.7% of patients were developing local recurrence and 12.6% patients were developing distant recurrence. Poor prognosis and subsequent mortality are linked with distant recurrence like an involvement of organs like bone, lung, liver, and brain.^{20,21}

The patterns of recurrence found in this study are relatively similar to the published regional data previously and underline the need to keep following up and identify recurrent disease in its infancy.²² The general results of the proposed study underscore the dire role of clinicopathological factors, molecular subtypes, and treatment modalities in survival outcomes of breast cancer patients.^{23,24} Timely initiation of effective treatment plans, proper the classification of the molecular profiles and detection of the disease at early stages are also important elements towards enhancing the survival of women with breast cancer in Pakistan and also lessening the disease burden.²⁵

LIMITATIONS AND RECOMMENDATIONS

The current research also posed some limitations, which must be taken into consideration during the interpretation of the findings. The study was performed in one tertiary care center, so the results might not be relevant to the entire population. Selection bias may also come due to the non-probability consecutive sampling. Secondly, some percentage of patients followed up less than five years and this could have influenced the overall study of the survival outcome. Moreover, more advanced survival analysis techniques and genetic profiling were not present in the study and would have been helpful, as more prognostic factors and long-term outcomes would have been observed. According to the results in this study, early screening and awareness activities have been suggested to be enhanced to encourage the diagnosis of breast cancer on time, especially among high-risk groups. Survival data accuracy and generalizability are suggested to be improved by conducting multicenter studies with longer follow-up time and larger sample size. They should integrate the use of molecular profiling and targeted therapy to enhance personalized treatment planning and survival. Also, early follow-up procedures ought to be adopted in order to observe recurrence at an early stage and enhance a long-term prognosis in breast cancer patients in Pakistan.

REFERENCES

1. Sherwani M, Vohra L, Ali D, Soomro R, Adnan S, Idrees R. Clinicopathological features and survival outcomes of metaplastic breast carcinoma—an observational multi-centric study. *Breast Cancer: Targets and Therapy*. 2023 Dec 31;237-50.
2. Shaikh K, Arif A, Mooghal M, Vohra L. Unveiling the Clinicopathological Outcomes of Breast Cancer in Young Women: A perspective from resource-limited settings. *Sultan Qaboos University Medical Journal*. 2025 May 2;25(1):658.
3. Kretzmann HG, Adeniyi OV. Clinicopathological and molecular subtypes of breast cancer in the Eastern Cape, South Africa: A two-year retrospective study. *Plos one*. 2025 Jul 21;20(7):e0325387.
4. Depar FN, Chaudhary AJ, Hameed J, Abbasi FS, Uzma B, Ali A, Akhtar N, Khan R, Siddiqi A, Riaz S. Cancer stem cell markers, chemotherapy response, and survival in triple-negative breast cancer. *World Journal of Clinical Oncology*. 2026 Feb 24;17(2):116251.
5. Khan SR, Soomar SM, Asghari T, Ahmed A, Moosajee MS. Prognostic factors, oncological treatment and outcomes of uterine sarcoma: 10 years' clinical experience from a tertiary care center in Pakistan. *BMC cancer*. 2023 Jun 5;23(1):510.
6. Belachew EB, Desta AF, Deneke DB, Fenta BD, Alem AT, Abafogi AK, Lukas FY, Bezabih M, Sewasew DT, Kantelhardt EJ, Tessema TS. Clinicopathological features of invasive breast cancer: A five-year retrospective study in Southern and South-Western Ethiopia. *Medicines*. 2023 May 4;10(5):30.
7. Munawwar A, Sajjad A, Faisal S, Rasul A, Zarbab A, Ashraf A, Bibi A, Ahmad A, Siddique S. Basic findings of incidence of breast cancer in Allied Hospital Faisalabad, Pakistan: a retrospective study. *Iranian Journal of Public Health*. 2023 Jun 13;52(6):1199-206.
8. Eziagu UB. Relationship between Age, Histologic Grade, Tumour Size, Immunohistochemical Biomarkers Expressions and Molecular Subtypes of Invasive Breast Carcinoma in Ilorin, Nigeria. *Pan African Journal of Life Sciences*. 2023 Jan 1.
9. Venkata VL, Tharappel DC, Vashishta GD, Ramesh RS, Srikanth N, Kashiappa AC. Clinicopathological Characteristics and Outcomes of Metaplastic Breast Cancer: Experience from a Tertiary Cancer Center in India. *Indian Journal of Medical and Paediatric Oncology*. 2025 Dec 18.
10. Shah A, Haider G, Abro N, Hashmat S, Chandio S, Shaikh A, Abbas K, Shaikh A. Correlation between site and stage of breast cancer in women. *Cureus*. 2022 Feb 27;14(2).
11. Al Balushi M, Mahmoud EE, Al Ishaq Z, Al-Amri SM, Al-Sayegh H, Alghamdi AA, Alqahtani HM, Abdullah G, Almutairi A, Alasser Y, Al-Ajmi AM. Kingdom of Saudi Arabia Ministry of Health Agency of Public Health Assistant Agency for Preventive Health Field Epidemiology Training Program Breast cancer in women aged 40 and below reported to Sultan Qaboos Cancer Care Comprehensive Center: 20 Years Ret. *Journal of International Crisis and Risk Communication Research*. 2024;7(S8):3121.
12. Adnan Y, Ali SA, Farooqui HA, Kayani HA, Idrees R, Awan MS. High CD44 Immunoexpression Correlates with Poor Overall Survival: Assessing the Role of Cancer Stem Cell Markers in Oral Squamous Cell Carcinoma Patients from the High-Risk Population of Pakistan. *International journal of surgical oncology*. 2022;2022(1):9990489.
13. Damera VV, Chowdhury Z, Tripathi M, Singh R, Verma RK, Jain M, DAMERA II VV, CHOWDHURY Z, SINGH R, KUMAR R. Clinicopathologic features of metaplastic breast carcinoma: experience from a tertiary cancer center of North India. *Cureus*. 2022 Sep 9;14(9).
14. Harist M, Fertilita S, Prasetyo NT, Abdurrahman MR. The expression of Ki-67 and clinicohistopathological characteristics of breast cancer in Southern Sumatra, Indonesia. *JKKI: Jurnal Kedokteran dan Kesehatan Indonesia*. 2024 Aug 27:182-91.
15. Amin A, Mehak F, Azhar F, Abdullah I, Amin M. Frequency of Disease-Free and Overall Survival Outcomes in Triple-Negative Breast Cancer Patients Following Neoadjuvant Chemotherapy. *Journal of Health, Wellness and Community Research*. 2025 May 31:e309-.
16. Püsküllüoğlu M, Konieczna A, Świdarska K, Streb J, Pieniążek M, Grela-Wojewoda A, Pacholczak-Madej R, Mucha-Małecka A, Mituś JW, Szpor J, Kunkiel M. Treatment outcomes and prognostic factors in nonmetastatic metaplastic breast cancer patients: a multicenter retrospective cohort study. *Acta oncologica*. 2024 Aug 4;63:40413.
17. Benye TA, Jibrin PG, Achusi BI, Olah FG, Nwana EJ. Histopathological profile of triple negative breast carcinomas seen in patients in National Hospital, Abuja over a 10-year period (January 2010-December 2019). *medRxiv*. 2024 Sep 30:2024-09.
18. Abdelmoula G, Garci M, Abdessayed N, Makni M, Abdeljabbar A, Babay W, Ben Saada N, Mathlouthi N, Belghith C, Slimani O. Is the incidence of non-epithelial ovarian tumors on the rise? insights from a Tunisian tertiary center. *Frontiers in Oncology*. 2025 Oct 15;15:1606243.

19. Püsküllüoğlu M, Swiderska K, Konieczna A, Streb J, Grela-Wojewoda A, Rudzinska A, Dobrzańska J, Pacholczak-Madej R, Mucha-Malecka A, Kunkiel M, Mitus JW. Clinical analysis of metaplastic breast carcinoma with distant metastases: A multi centre experience. *Oncology Letters*. 2024 Mar 8;27(5):198.
20. El Helou MO. PRESENTATION, TREATMENT MODALITIES, AND OUTCOMES OF BREAST CANCER IN YOUNG FEMALES: A COMPARISON WITH OLDER AGE GROUP IN LEBANON (Doctoral dissertation).
21. Zaakouk M, Longworth A, Hunter K, Jiman S, Kearns D, El-Deftar M, Shaaban AM. Detailed profiling of the tumor microenvironment in ethnic breast cancer, using tissue microarrays and multiplex immunofluorescence. *International Journal of Molecular Sciences*. 2024 Jun 13;25(12):6501.
22. Wiguna IG, Remitha NP, Sadvika IG, Wiranata S, Putra IW, Adiputra PA, Supadmanaba IG, Wihandani DM. Pretreatment leukocyte count ratios as metastatic predictive factors in luminal type breast cancer. *Asian Pacific journal of cancer prevention: APJCP*. 2022 May;23(5):1595.
23. Mukhtar Z, Faisal A, Mudassir G, Mamoon N. Correlation between HER2/neu protein overexpression on Immunohistochemistry and Fluorescent in Situ Hybridization (FISH) in breast carcinoma: Problems in developing countries. *Pakistan Journal of Medical Sciences*. 2023 Nov;39(6):1814.
24. OBIAJULU F. Analysis of the Biological Drivers of Aggressive Behaviour in Breast Cancer in Young Women.
25. Lim YX, Lim ZL, Ho PJ, Li J. Breast cancer in Asia: incidence, mortality, early detection, mammography programs, and risk-based screening initiatives. *Cancers*. 2022 Aug 30;14(17):4218.