Section: Pathology

Original Research Article

# HISTOPATHOLOGICAL PATTERNS AND LUMINAL SUBTYPES OF BREAST CANCER PATIENTS IN A TERTIARY CARE CENTRE

*Vutukuru Venkata Sushma [1], Sahitya Chennapragada[2], Gudeli Vahini[3]*

*[1]Associate Professor, Department of Pathology, Alluri Sitarama Raju Academy of Medical Sciences (ASRAM Medical College & Hospital) Malkapuram, West Godavari NH-5 (Vijayawada–Visakhapatnam, Andhra Pradesh, India.*
*[2]Undergraduate medical student, Alluri Sitarama Raju Academy of Medical Sciences (ASRAM Medical College & Hospital) Malkapuram, West Godavari NH-5 (Vijayawada–Visakhapatnam, Andhra Pradesh, India.*
*[3]Professor & Head, Department of Pathology, Alluri Sitarama Raju Academy of Medical Sciences (ASRAM Medical College & Hospital) Malkapuram, West Godavari NH-5 (Vijayawada–Visakhapatnam, Andhra Pradesh, India.*

***Received*** *: 14/05/2026*
***Received in revised form*** *: 03/07/2026*
***Accepted*** *: 18/07/2026*

**Corresponding Author:**
**Dr. Venkata Sushma Vutukuru,** Associate Professor, Department of Pathology, Alluri Sitarama Raju Academy of Medical Sciences (ASRAM Medical College & Hospital) Malkapuram, West Godavari NH-5 (Vijayawada–Visakhapatnam, Andhra Pradesh, India.
Email: sushma.vutukuru28@gmail.com

**DOI:** 10.70034/ijmedph.2026.3.233

**Source of Support:** Nil,
**Conflict of Interest:** None declared

**Int J Med Pub Health**
2026; 16 (3); 1442-1446

ABSTRACT

**Background:** Breast cancer is a heterogeneous disease exhibiting diverse histopathological and molecular characteristics that influence prognosis and treatment. Immunohistochemical (IHC) classification using estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor-2 (HER2) serves as a practical surrogate for molecular subtyping in routine practice. The objective is to study the histopathological patterns of breast carcinoma, determine the distribution of luminal subtypes using IHC, and assess their association with clinicopathological parameters.

**Materials and Methods:** A retrospective descriptive study was conducted on 40 female patients diagnosed with invasive breast carcinoma at a tertiary care centre between January and July 2024. Histopathological typing and grading were performed using the Nottingham grading system. IHC evaluation of ER, PR, and HER2 was used to classify tumors into luminal A, luminal B, HER2-enriched, and triple-negative subtypes. Associations with age, tumor type, and grade were analyzed using the Chi-square test.

**Results:** The median age was 55.5 years. Invasive ductal carcinoma was the predominant histological type (87.5%). Luminal B and HER2-enriched subtypes were the most frequent (30% each), followed by luminal A (25%) and triple-negative breast cancer (15%). A significant association was observed between molecular subtype and tumor grade ($p = 0.039$), while age and tumor type showed no significant association.

**Conclusion:** Luminal B and HER2-enriched subtypes predominated in this cohort, reflecting a regional trend toward aggressive disease patterns. IHC-based subtyping remains an effective and economical tool for prognostication and therapeutic decision-making.

**Keywords:** Breast carcinoma, Histopathology, Immunohistochemistry, Luminal subtypes, HER2.

## INTRODUCTION

Breast cancer is the most commonly diagnosed malignancy among women worldwide and remains a leading cause of cancer related mortality, particularly in low and middle income countries.[1] In India, the burden of breast cancer continues to rise, with more than 1.4 million new cancer cases estimated in 2022, and breast cancer accounting for the largest proportion among women.[1] The disease is characterised by marked histopathological and molecular heterogeneity, resulting in wide variation in prognosis and therapeutic response.[2]

While histomorphological evaluation forms the cornerstone of diagnosis, immunohistochemistry (IHC) has become indispensable in routine pathology practice for prognostication and treatment planning. Assessment of estrogen receptor (ER), progesterone receptor (PR), and human epidermal

growth factor receptor 2 (HER2) serves as a practical surrogate for molecular profiling when genomic assays are not readily available.[3,4] Based on the expression of these markers, breast carcinomas are classified into luminal A, luminal B, HER2 enriched, and triple negative subtypes, each associated with distinct biological behaviour and clinical outcomes.[5]

Several studies from India and other Asian populations have demonstrated regional variation in the distribution of molecular subtypes, with a relatively higher prevalence of aggressive phenotypes such as luminal B, HER2 enriched, and triple negative breast cancer compared with Western cohorts.[6,7] Understanding these patterns at the institutional and regional level is essential for optimising management strategies. The present study therefore aimed to analyse the histopathological patterns and IHC defined luminal subtypes of breast carcinoma and to correlate these subtypes with clinicopathological parameters in a tertiary care centre.

## MATERIALS AND METHODS

**Study Design and Setting:** This retrospective descriptive study was conducted in the Department of Pathology at a tertiary care teaching hospital in India.

**Study Period:** January 2024 to July 2024.

**Study Population and Sample Size:** The study included 40 female patients diagnosed with breast carcinoma during the study period whose complete histopathological and immunohistochemical data were available.

**Inclusion Criteria**

- Female patients aged ≥18 years
- Histologically confirmed breast carcinoma
- Availability of ER, PR, and HER2 immunohistochemistry results

**Exclusion Criteria**

- Male breast cancer patients
- Cases lacking ER, PR, or HER2 evaluation

**Histopathological Evaluation:** Formalin-fixed, paraffin-embedded tissue sections were stained with haematoxylin and eosin. Tumours were classified according to the WHO classification of breast tumours. Histological grading was performed using the Nottingham modification of the Bloom–Richardson grading system.

**Immunohistochemistry:** ER and PR status were evaluated using the Allred scoring system. HER2 expression was assessed by the labelled streptavidin–biotin method and scored from 0 to 3+ according to established guidelines.

**Molecular Subtyping**

Tumours were categorised into four molecular subtypes based on IHC results:

- Luminal A: ER+/PR+, HER2−
- Luminal B: ER+/PR+, HER2+
- HER2-enriched: ER−/PR−, HER2+
- Triple-negative: ER−/PR−, HER2−

**Statistical Analysis**

Data were entered into Microsoft Excel and analysed using SPSS version 29. Categorical variables were expressed as frequencies and percentages. Associations between molecular subtype and clinicopathological parameters were assessed using the Chi-square test. A p-value <0.05 was considered statistically significant.

**Ethical Considerations**

Ethical approval was obtained from the Institutional Ethics Committee. A waiver of informed consent was granted due to the retrospective nature of the study.

## RESULTS

A total of 40 female patients with breast carcinoma were included in the study. The median age at presentation was 55.5 years, with the majority of patients in the 61–70-year age group.

**Histopathological Patterns**

Invasive ductal carcinoma was the most common histological type, accounting for 87.5% of cases. Other subtypes included invasive lobular carcinoma (5%), ductal-lobular carcinoma (2.5%), mixed carcinoma (2.5%), and other rare variants (2.5%).

**Tumour Grade**

Based on the Nottingham grading system, 40% of tumours were grade I, 47.5% were grade II, and 12.5% were grade III.

**Receptor Status**

ER positivity was observed in 52% of cases, PR positivity in 45%, and HER2 positivity in 60% of cases.

**Molecular Subtypes**

Luminal B and HER2-enriched subtypes were the most frequent (30% each), followed by luminal A (25%) and triple-negative breast cancer (15%).

**Clinicopathological Correlation**

A statistically significant association was found between molecular subtype and tumour grade ($p = 0.039$). No significant association was observed between molecular subtype and age ($p = 0.089$) or tumour type ($p = 0.804$).

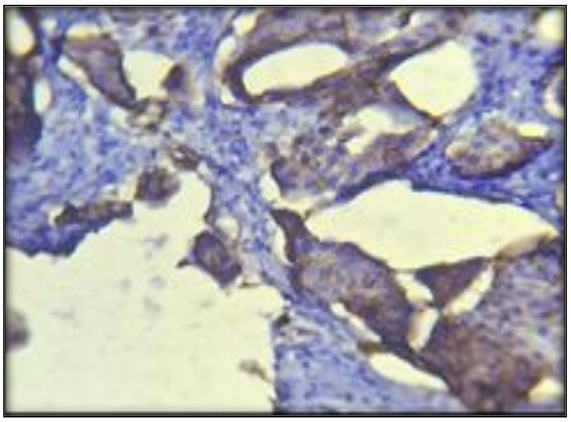

**Figure 1: Breast cancer showing cell membrane positivity to her 2Neu**

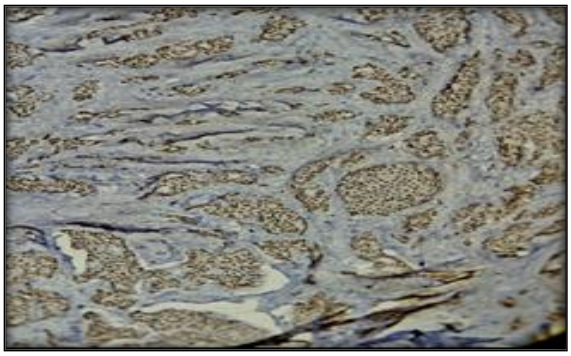

**Figure 2: Breast cancer tissue showing diffuse nuclear positivity to PR**

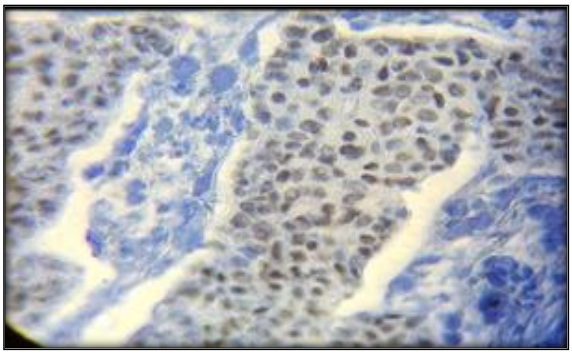

**Figure 3: Breast tissue showing diffuse nuclear positivity to ER**

**Table 1: Age-wise distribution of breast cancer patients included in the study**

| Age group (years) | Number of cases (n) | Percentage (%) |
|---|---|---|
| 31–40 | 3 | 7.5 |
| 41–50 | 12 | 30.0 |
| 51–60 | 10 | 25.0 |
| 61–70 | 13 | 32.5 |
| 71–80 | 1 | 2.5 |
| 81–90 | 1 | 2.5 |
| **Total** | **40** | **100** |

**Table 2: Distribution of histopathological patterns of breast carcinoma**

| Histopathological type | Number of cases (n) | Percentage (%) |
|---|---|---|
| Invasive ductal carcinoma (NST) | 35 | 87.5 |
| Invasive lobular carcinoma | 2 | 5.0 |
| Ductal–lobular carcinoma | 1 | 2.5 |
| Mixed carcinoma | 1 | 2.5 |
| Other variants | 1 | 2.5 |
| Total | 40 | 100 |

**Table 3: Distribution of breast cancer cases based on Nottingham histological grading**

| Tumour grade | Number of cases (n) | Percentage (%) |
|---|---|---|
| Grade I | 16 | 40.0 |
| Grade II | 19 | 47.5 |
| Grade III | 5 | 12.5 |
| Total | 40 | 100 |

**Table 4: Immunohistochemical expression of ER, PR, and HER2 in breast cancer patients**

| Receptor status | Positive cases n (%) | Negative cases n (%) |
|---|---|---|
| Estrogen receptor (ER) | 21 (52.5) | 19 (47.5) |
| Progesterone receptor (PR) | 18 (45.0) | 22 (55.0) |
| HER2 | 24 (60.0) | 16 (40.0) |

**Table 5: Immunohistochemistry-based molecular subtype distribution of breast carcinoma**

| Molecular subtype | Number of cases (n) | Percentage (%) |
|---|---|---|
| Luminal A (ER+/PR+, HER2−) | 10 | 25.0 |
| Luminal B (ER+/PR+, HER2+) | 12 | 30.0 |
| HER2-enriched (ER−/PR−, HER2+) | 12 | 30.0 |
| Triple-negative (ER−/PR−, HER2−) | 6 | 15.0 |
| Total | 40 | 100 |

**Table 6: Association of Molecular Subtypes with Clinicopathological Parameters**

| Parameter | Luminal A n (%) | Luminal B n (%) | TNBC n (%) | HER2-enriched n (%) | p-value |
|---|---|---|---|---|---|
| Age | | | | | 0.089 |
| ≤50 years | 3 (30.0) | 3 (25.0) | 5 (83.3) | 4 (33.3) | |
| >50 years | 7 (70.0) | 9 (75.0) | 1 (16.7) | 8 (66.7) | |
| Tumour type | | | | | 0.804 |
| IDC | 8 (80.0) | 11 (91.7) | 5 (83.3) | 11 (91.7) | |
| Non-IDC | 2 (20.0) | 1 (8.3) | 1 (16.7) | 1 (8.3) | |
| Tumour grade | | | | | 0.039* |
| Grade I | 6 (60.0) | 6 (50.0) | 0 (0.0) | 4 (33.3) | |
| Grade II | 3 (30.0) | 6 (50.0) | 3 (50.0) | 7 (58.3) | |
| Grade III | 1 (10.0) | 0 (0.0) | 3 (50.0) | 1 (8.3) | |

***Statistically significant ($p < 0.05$)**

## DISCUSSION

Breast carcinoma is a biologically heterogeneous disease with significant variation in histopathology, molecular characteristics, and clinical behaviour. In the present tertiary care–based study, invasive ductal carcinoma of no special type was the predominant histological subtype, and luminal B and HER2 enriched tumours constituted the largest molecular subgroups. This pattern differs from many Western series, in which luminal A tumours predominate, but is consistent with several Indian and South Asian studies reporting a higher frequency of biologically aggressive subtypes.[6–8]

The predominance of invasive ductal carcinoma observed in this study is in keeping with the World Health Organization classification and previously published literature, where IDC accounts for approximately 70–90% of invasive breast cancers.[9] The relatively high proportion of intermediate and high grade tumours in our cohort suggests delayed presentation, a common challenge in low and middle income countries, where population based screening programmes are limited and diagnosis often occurs at a symptomatic stage.[1,10]

Molecular subtyping using ER, PR, and HER2 demonstrated a predominance of luminal B and HER2 enriched subtypes. Similar findings have been reported by Gulzar et al. and Hashmi et al., who observed a higher prevalence of luminal B tumours in South Asian populations compared with Western cohorts.[7,11] These differences may be attributed to demographic factors, tumour biology, and variations in health care access, as well as methodological differences in receptor testing and interpretation.

A statistically significant association was observed between molecular subtype and tumour grade, underscoring the prognostic relevance of IHC based classification. Luminal A tumours were more frequently low grade, while luminal B, HER2 enriched, and triple negative subtypes were associated with higher histological grades. This correlation has been consistently demonstrated in previous studies and reflects the more aggressive biological behaviour of non-luminal A tumours.[5,8,12]

The high proportion of HER2 positive tumours in this cohort is clinically important. Although HER2 overexpression is associated with aggressive disease, the introduction of anti HER2 targeted therapies has significantly improved outcomes in this subgroup. Long term follow up studies have demonstrated sustained benefits of trastuzumab based therapy in terms of disease free and overall survival.[13,14] Ensuring accurate HER2 testing and access to targeted therapy is therefore crucial, particularly in regions where HER2 positive disease appears relatively common.

Triple negative breast cancer, although less frequent in this study, remains a therapeutically challenging subtype due to the absence of established targeted therapies. Recent clinical trials have shown improved outcomes with the addition of immunotherapy to chemotherapy in selected patients with early stage triple negative disease, marking an important advance in management.[15] However, access to such therapies remains limited in many resource constrained settings.

Limitations: The main limitations of this study include its retrospective design, small sample size, and lack of survival outcome data. In addition, molecular assays such as PAM50 were not performed, and reliance on IHC based surrogate classification may not fully capture underlying genomic heterogeneity. Nevertheless, in routine clinical practice, particularly in resource limited settings, IHC based molecular subtyping remains a cost effective and clinically meaningful approach for risk stratification and therapeutic decision making.[4,5]

## CONCLUSION

In this tertiary-care cohort (dissertation dataset) luminal B and HER2-enriched subtypes were common and associated with higher grade pathology. IHC-based receptor profiling remains essential and practical for prognostication and treatment planning locally; improving access to accurate HER2-directed therapy and inclusion of Indian patients in contemporary therapeutic trials should be priorities to reduce outcome disparities.

## REFERENCES


1. Sathishkumar K, Chaturvedi M, Das P, Stephen S, Mathur P. Cancer incidence estimates for 2022 and projection for 2025: Results from the National Cancer Registry Programme, India. *Indian J Med Res*. 2023;156(4):598–607.
2. Xiong X, Deng J, Zhu J. Breast cancer: molecular mechanisms and therapeutic strategies. Signal Transduct Target Ther. 2024;9:108.
3. Allison KH, Hammond MEH, Dowsett M, McKernin SE, Carey LA, Fitzgibbons PL, et al. Estrogen and progesterone receptor testing in breast cancer: ASCO/CAP guideline update. J Clin Oncol. 2023;41(10):1816–1837.
4. Wolff AC, Hammond MEH, Allison KH, Harvey BE, Mangu PB, Bartlett JMS, et al. Human epidermal growth factor receptor 2 testing in breast cancer: ASCO/CAP guideline update. J Clin Oncol. 2023;41(22):3867–3897.
5. Orrantia-Borunda E, Anchondo-Nuñez P, Acuña-Aguilar LE, Gómez-Valles FO, Ramírez-Valdespino CA. Subtypes of breast cancer. StatPearls. Treasure Island (FL): StatPearls Publishing; 2022.
6. Jonnada PK, Raghavendra A, Sharma A. Prevalence of molecular subtypes of breast cancer in India: A systematic review and meta-analysis. Asian Pac J Cancer Prev. 2020;21(12):3569–3578.
7. Gulzar R, Shahid R, Saleem O. Molecular subtypes of breast cancer by immunohistochemical profiling. Int J Pathol. 2018;16(1):7–12.
8. Hashmi AA, Aijaz S, Khan SM, Mahboob R, Irfan M, Zafar NI, et al. Prognostic parameters of luminal A and luminal B intrinsic breast cancer subtypes. World J Surg Oncol. 2018;16:1–9.
9. WHO Classification of Tumours Editorial Board. Breast Tumours. 5th ed. Lyon: International Agency for Research on Cancer; 2022.

10. National Academy of Medical Sciences (India). Breast cancer in India: burden, challenges and prevention strategies. NAMS Ann. 2025.
11. Carvalho E, Figueiredo J, Reis CA. Molecular subtypes of breast cancer and clinical implications. Cancers (Basel). 2025;17(7):1102.
12. Tapia-Uriol P, Ruiz-Martínez S, Martínez-Barba E, García-García F, Bernal-Soriano MC. Intrinsic subtypes of breast cancer and prognostic relevance. Front Med. 2025;12:1553910.
13. Joensuu H, Fraser J, Wildiers H, Huovinen R, Auvinen A. Long-term outcomes of adjuvant trastuzumab in early HER2-positive breast cancer. JAMA Netw Open. 2024;7(2):e241234.
14. Bonomi G, Cottu PH, Curigliano G. Real-world outcomes in HER2-positive breast cancer treated with anti-HER2 therapy. Breast Cancer Res Treat. 2025;191(1):1–10.
15. Schmid P, Cortes J, Dent R, Pusztai L, McArthur H, Kümmel S, et al. Pembrolizumab for early triple-negative breast cancer. N Engl J Med. 2022;386(6):556–567.