OPEN ACCESS

ISAR Journal of Medical and Pharmaceutical Sciences

Volume 3, Issue 10, 2025 | Page: 34-39

Abbriviate Title- ISAR J Med Pharm Sci

ISSN (Online)- 2584-0150

https://isarpublisher.com/journal/isarjmps

Histopathologic Patterns of Triple-Negative Breast Cancer in Makurdi, North-Central Nigeria

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Article History

Received: 01.08.2025

Accepted: 24.09.2025

Published: 22.10.2025

Abstract: -

Background: Triple-negative breast cancer (TNBC), defined by the absence of estrogen receptor (ER), progesterone receptor (PR), and HER2 expression, is an aggressive breast cancer subtype associated with poor prognosis and limited targeted therapy. TNBC prevalence is disproportionately high among women of African ancestry, yet regional histopathologic data remain limited in North-Central Nigeria.

Objective: To determine the histopathologic patterns and immunohistochemical profiles of TNBC in Makurdi, North-Central Nigeria.

Methods: A retrospective descriptive study of invasive ductal carcinoma (IDC) cases diagnosed between 2021–2024 at Benue State University Teaching Hospital. Only histologically confirmed TNBC cases with complete ER, PR, and HER2 status were included. Tumours were classified and graded using WHO 2019 criteria and Nottingham grading. Data on patient demographics, histologic subtype, and tumour grade were analysed using descriptive statistics.

Results: Among 290 IDC cases, 179 (61.6%) were TNBC. Patients' ages ranged 20–89 years, with peak incidence in the 50–59 years' group (32.1%). TNBC predominated in middle-aged women (40–59 years). Most tumours were high-grade invasive ductal carcinoma of no special type (NST), with a minority showing special histologic subtypes. Immunohistochemistry revealed ER negativity in 58.3%, PR negativity in 60.3%, and HER2 negativity in 66.2% of cases.

Conclusion: TNBC constitutes a substantial proportion of breast cancer in Makurdi, affecting predominantly middle-aged women, with high-grade invasive ductal carcinoma as the dominant histologic pattern. These findings underscore the need for region-specific diagnostic strategies, early detection programs, and tailored management protocols to address the high burden of TNBC in North-Central Nigeria.

Keywords: ER, HER2, Histopathology, Immunohistochemistry, Invasive Ductal Carcinoma, North-Central Nigeria, PR, Triple-negative breast cancer.

Cite this article:

Ngbea, J. A.; Gbaa, L. Z.; Omolabake, B. I.; Dzuachii, O. D.; Agada E.; Anenga, R. N.; Orhungurh, C. M., (2025). Histopathologic Patterns of Triple-Negative Breast Cancer in Makurdi, North-Central Nigeria. *ISAR Journal of Medical and Pharmaceutical Sciences, 3*(10), 34-39.

Introduction:

Triple-Negative Breast Cancer (TNBC) is immunohistochemically defined by the absence of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2) overexpression or amplification[1]. It accounts for approximately 10–24% of all breast cancers globally and is associated with an aggressive course, early recurrence, and poor prognosis, most commonly in the form of Invasive Carcinoma of No Special Type (NST) [2]. While TNBC often overlaps with the molecularly defined basal-like subtype, it represents a heterogeneous group encompassing histopathological entities such as metaplastic, medullary, and adenoid cystic carcinomas, which have differing prognoses [3-5].

Over the past decade, considerable global efforts have focused on characterizing TNBC heterogeneity for therapeutic stratification, consistently showing the predominance of high-grade Invasive Carcinoma (IDC), NST, while recognizing special subtypes with more favorable outcomes [3-5]. In sub-Saharan Africa, the burden of TNBC is particularly pronounced, with women of African ancestry presenting at younger ages and with more advanced-stage disease [6-8].

In Nigeria, studies over the last 10 years report a high prevalence of TNBC, ranging from 18% to 43.5%, with patients frequently presenting with high-grade disease at late stages, often a decade earlier than in high-income countries [7-10]. In North-Central Nigeria, including Makurdi, recent histopathological surveys confirm the dominance of Invasive Ductal Carcinoma (IDC), NST, and a younger mean age of breast cancer presentation [11-13].

This study is therefore essential to delineate the histological spectrum of TNBC in Makurdi, North-Central Nigeria. By examining the local histopathologic distribution, it aims to provide vital regional data to inform diagnostic protocols, improve prognostic stratification, and identify potential local biological variations within this aggressive but treatable breast cancer subtype.

Materials and Methods

This was a retrospective, descriptive histopathological study at the department of Anatomic Pathology of the Benue State University Teaching Hospital (BSUTH), Makurdi, Benue State, North-Central Nigeria. The laboratory serves as a referral centre for the region. All histologically confirmed cases of breast carcinoma diagnosed between 2021 and 2024 were retrieved from the departmental archives. Cases with available paraffin-embedded tissue blocks and complete histopathology reports were eligible. Only carcinomas confirmed as triple-negative (ER-, PR-, and HER2-negative) based on immunohistochemistry (IHC) were included. Cases with incomplete receptor status data or poorly preserved tissue unsuitable for further evaluation were excluded.

Demographic details (age, sex) and clinical information available in request forms were extracted. Histopathology slides were reviewed, and representative blocks were selected for IHC where necessary.

Sections stained with haematoxylin and eosin (H&E) were examined for tumour type, grade, and morphological features according to the 2019 WHO Classification of Breast Tumours. The Nottingham histologic grading system (Elston–Ellis modification of Scarff–Bloom–Richardson) was used to assign tumour grade. Morphological variants, presence of lymphovascular invasion, necrosis, and special features were documented.

IHC for ER, PR, and HER2 was performed using standard protocols. Tumours were classified as TNBC when they showed <1% nuclear staining for ER and PR and were negative for HER2 (0 or 1+ by IHC, or 2+ with negative in-situ hybridization where available).

Data were entered into Microsoft Excel and analysed using IBM SPSS version 27. Descriptive statistics (frequencies, percentages, means, and ranges) were generated. Results were presented in tables and charts to illustrate demographic patterns, histologic subtypes, and tumour grades

Results:

A total of 290 cases of invasive ductal carcinoma (IDC) of the breast were evaluated by immunohistochemistry for ER, PR, and HER2 status.

Estrogen receptor (ER): 121 cases (41.7%) were ER-positive, while 169 cases (58.3%) were ER-negative (Figure 2). Progesterone receptor (PR): 115 cases (39.7%) were PR-positive, whereas 175 cases (60.3%) were PR-negative (Figure3). HER2: 98 cases (33.8%) were HER2-positive, and 192 cases (66.2%) were HER2-negative. Overall (Figure), 179 cases (61.6%) met the criteria for triple-negative breast cancer (TNBC) (ER–, PR–, HER2–) (Tables 1 and Figure 1).

The patients' ages ranged from 20 to 89 years. The peak age group was 50–59 years (32.1%), followed by 40–49 years (19.7%). The least represented group was the 80–89-year-old age range (6.9%). There was no male breast analysed or presented in the study (Table 2).

Table 1: Age Distribution and Immunohistochemical Profile of IDC (n = 290)

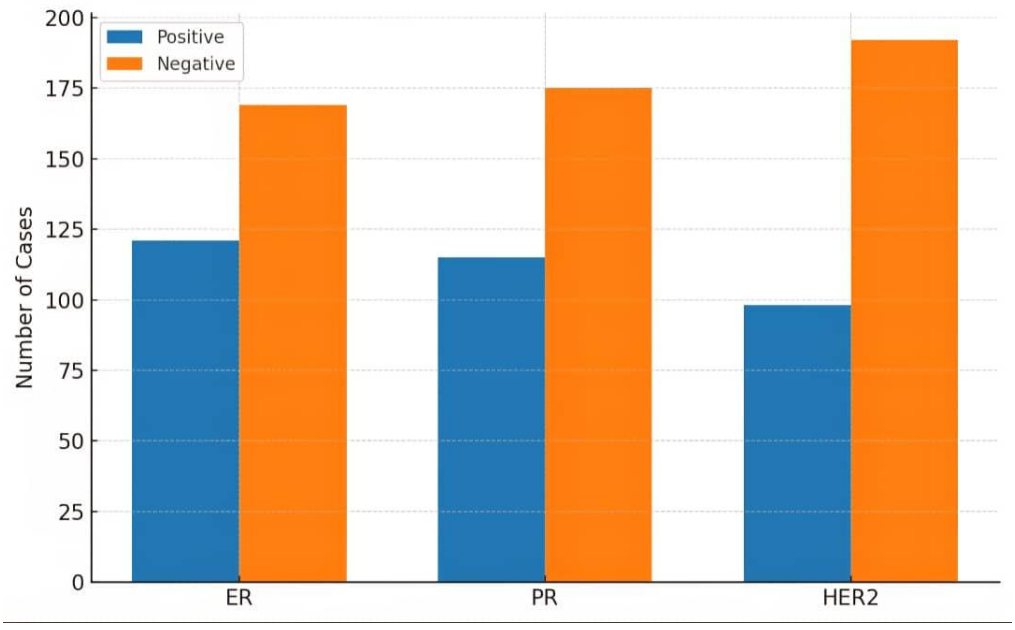
Age group (years)	Total cases (n, %)	ER+ n (%)	ER– n (%)	PR+ n (%)	PR– n (%)	HER2+ n (%)	HER2– n (%)	TNBC n (%)
20–29	25 (8.6)	6 (5.0)	19 (11.2)	10 (8.7)	15 (8.6)	5 (5.1)	20 (10.4)	**9 (5.0)**
30–39	21 (7.2)	10 (8.3)	11 (6.5)	8 (7.0)	13 (7.4)	5 (5.1)	16 (8.3)	**8 (4.5)**
40–49	57 (19.7)	30 (24.8)	27 (16.0)	20 (17.4)	37 (21.1)	22 (22.5)	35 (18.2)	**35 (19.6)**
50–59	93 (32.1)	43 (35.6)	50 (29.6)	40 (34.8)	53 (30.3)	45 (45.9)	48 (25.0)	**59 (32.9)**
60–69	39 (13.5)	11 (9.1)	28 (16.6)	20 (17.4)	19 (10.9)	6 (6.1)	33 (17.2)	**27 (15.1)**
70–79	35 (12.1)	11 (9.1)	24 (14.2)	9 (7.8)	26 (14.9)	7 (7.1)	28 (14.6)	**24 (13.4)**
80–89	20 (6.9)	10 (8.3)	10 (5.9)	8 (7.0)	12 (6.9)	8 (8.2)	12 (6.3)	**17 (9.5)**
Total	**290 (100.0)**	**121 (41.7)**	**169 (58.3)**	**115 (39.7)**	**175 (60.3)**	**98 (33.8)**	**192 (66.2)**	**179 (61.6)**

Table 2: Age Distribution of Triple-Negative Breast Cancer (n = 179)

Age group (years)	TNBC cases (estimated)	Percentage of TNBC (%)
20–29	9	5.0
30–39	8	4.5
40–49	35	19.6
50–59	59	32.9
60–69	27	15.1
70–79	24	13.4
80–89	17	9.5
Total	**179**	**100**

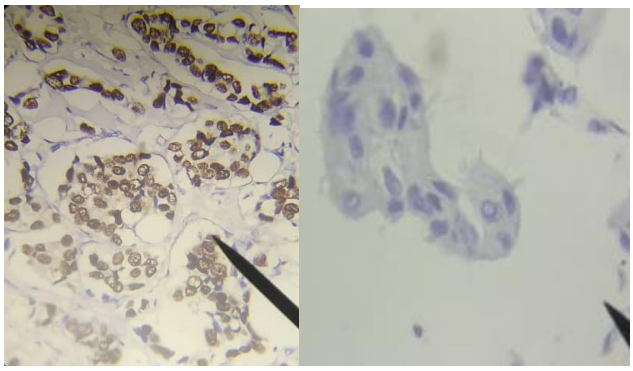
These findings revealed that IDC peaked in the fifth decade of life (50–59 years), that the majority of cases were ER– (58.3%), PR– (60.3%), and HER2– (66.2%), that triple-negative IDC accounted for 61.6% of all carcinomas studied, and that the burden of TNBC was most pronounced in the 40–59-year-old age bracket, affecting predominantly middle-aged women.

Figure 1: Immunohistochemical Patterns of Triple Negative Receptors in IDC.



Clustered bar chart showing the immunohistochemical status of estrogen receptor (ER), progesterone receptor (PR), and HER2 in invasive ductal carcinoma cases. Blue bars indicate positive cases; orange bars indicate negative cases. The chart demonstrates that the majority of cases were negative for all three receptors, reflecting the high prevalence of triple-negative breast cancer (TNBC) in this cohort.

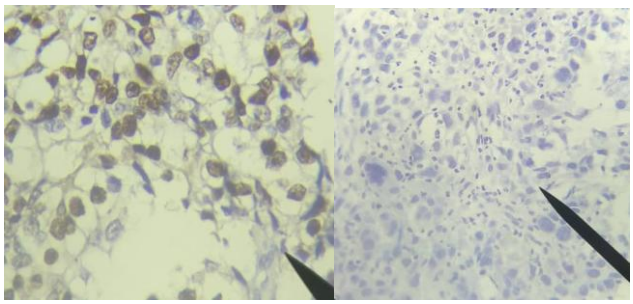
Figure 2: Invasive Ductal Carcinoma Showing Estrogen Receptor Status



ER Positive(A) **ER Negative (B)**

Photomicrograph of invasive ductal carcinoma showing estrogen receptor positive (A)and negative (B) x 100

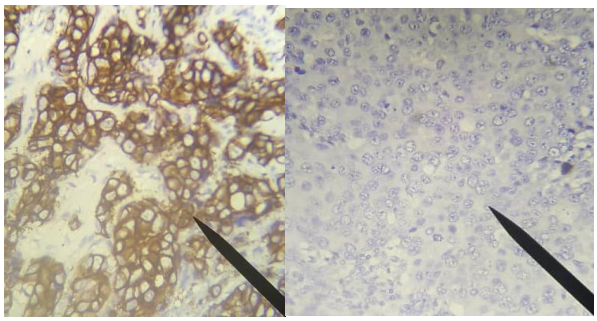
Figure 3: Invasive Ductal Carcinoma Showing Progesterone Receptor Status



PR Positive (A) **PR Negative (B)**

Photomicrograph of invasive ductal carcinoma showing progesterone receptor positive (A) and negative (B) x 100

Figure 4: Invasive Ductal Carcinoma Showing Her2neu Status



Her2neu Positive (A) **Her2neu Negative (B)**

Photomicrograph of invasive ductal carcinoma showing Her2neu positive (A) and negative (B) x 100

Discussion

Triple-negative breast cancer (TNBC), defined by the absence of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2) expression, is characterized by aggressive biological behavior, early recurrence, poor prognosis, and limited therapeutic options[14,15]. Histologically, TNBC is heterogeneous, most commonly manifesting as high-grade invasive ductal carcinoma (IDC), but it may also include medullary, metaplastic, and adenoid cystic variants[16,17].

In the present study from Makurdi, North-Central Nigeria, TNBC constituted **61.6%** of invasive ductal carcinomas, peaking among women aged 50–59 years. This proportion is considerably higher than global averages and aligns with reports from other Nigerian studies, indicating both the high prevalence of TNBC and its occurrence in relatively younger populations compared to high-income regions[18–20].

Globally, TNBC accounts for approximately 15–20% of breast cancers, but the prevalence is notably higher among women of African ancestry[21,22]. For instance, in Ghana, TNBC represents about **61%** of breast cancers, while Nigerian cohorts report frequencies between **35.7% and 52.6%**[23–25]. Similarly, African-American women in the United States experience a disproportionate TNBC burden, reflecting both genomic predisposition and socio-environmental factors[26,27].

Across Sub-Saharan Africa (SSA), studies from Nigeria, Ghana, and Mali report TNBC prevalence between 40% and 60%, underscoring regional uniformity in disease biology[23,25,28]. The high prevalence within SSA has been attributed to genetic susceptibility, younger age at diagnosis, high-grade histopathology, and delayed presentation due to inadequate diagnostic infrastructure[29–31].

In Nigeria specifically, the North-Central region, including Makurdi, demonstrates particularly high TNBC rates. The 61.6% prevalence in this study mirrors comparable rates from Sokoto (47.9%), Uyo (48.8%), and Lagos (52.6%), reflecting a persistent trend of aggressive, hormone receptor–negative breast cancer phenotypes in Nigerian women[18,20,24].

Conclusion:

This study demonstrates that triple-negative breast cancer (TNBC) accounts for a high proportion (61.6%) of invasive ductal carcinoma in Makurdi, North-Central Nigeria, predominantly affecting women aged 40–59 years. High-grade invasive ductal carcinoma of no special type (NST) was the most common histologic pattern, with a smaller representation of special TNBC subtypes. The findings reflect the aggressive nature and high regional burden of TNBC in this population, highlighting the need for targeted diagnostic, prognostic, and management strategies tailored to local patient demographics and tumour biology.

Recommendations:

1. Early Detection and Screening: Implement public health initiatives and community-based awareness programs to promote early detection of breast cancer, particularly among middle-aged women at higher risk of TNBC.
2. Enhanced Diagnostic Capacity: Expand immunohistochemistry services in regional hospitals to ensure accurate classification of breast cancer subtypes for appropriate management.
3. Regional Cancer Registries: Establish or strengthen population-based cancer registries in North-Central Nigeria to monitor TNBC prevalence, trends, and outcomes.
4. Research on Molecular and Genetic Profiles: Conduct molecular and genomic studies to identify local genetic and environmental factors contributing to TNBC, enabling precision medicine approaches.
5. Targeted Treatment Protocols: Develop and implement evidence-based treatment guidelines that consider the aggressive nature of TNBC and the limited availability of targeted therapies in the region.

Ethical Considerations:

Approval was obtained from the Institutional Health Research Ethics Committee of [insert institution name]. Patient confidentiality was maintained by de-identifying all retrieved records.

Source of Funding:

The study was supported by the Department of Anatomic Pathology, Benue State University Teaching Hospital, Makurdi, which provided access to archival tissue samples and laboratory facilities but we received no funding for the work.

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