DOI: 10.7860/JCDR/2026/91427.24396

Original Article

Pathology Section

Association of Residual Stromal Tumour Infiltrating Lymphocytes with Pathological Response Following Neoadjuvant Chemotherapy in Breast Carcinoma: A Retrospective Cohort Study

K HARI KRISHNA[1], MS SUPREETHA[2], A HEMALATHA[3], PN SREERAMULU[4]

ABSTRACT

Introduction: Tumour Infiltrating Lymphocytes (TILs) are important indicators of the host immune response and established predictive biomarkers primarily in Triple-Negative Breast Cancers (TNBC) and Human Epidermal Growth Factor Receptor 2 (HER2) - positive Breast Cancers (BC), but not across all BC subtypes. However, the biological and clinical significance of residual stromal TILs following Neoadjuvant Chemotherapy (NACT) remains incompletely understood. Unlike pre-treatment TILs, residual stromal TILs reflect the post-treatment tumour immune microenvironment and may provide additional information on pathological response and residual disease burden. Evaluating residual stromal TILs on routine Haematoxylin and Eosin (H&E)-stained sections offers a simple, reproducible, and cost-effective approach that could enhance routine pathological assessment.

Aim: To evaluate the distribution of residual stromal TILs in post-neoadjuvant surgical resection specimens and its association with pathological response.

Materials and Methods: This retrospective cohort study was conducted at the Department of Pathology, Sri Deveraj URS Medical College, Kolar, Karnataka, India, from January 2021 to January 2025. A total of 47 patients with histopathologically confirmed BC treated with NACT followed by surgery. Residual stromal TILs were evaluated in residual invasive tumour on post-treatment resection specimens using H&E sections, in accordance with International Immuno-oncology Biomarker Working Group recommendations, and categorised as low (<10%), intermediate (10-50%), or high (>50%). Pathological response was assessed using the Miller-Payne Grading System (MPGS) and Residual Cancer Burden (RCB) classification. Associations between residual stromal TIL categories and treatment response were analysed using Fisher's-exact test and Spearman's rank correlation coefficient.

Results: Among the 47 patients, low residual stromal TILs were identified in 17 (36.2%), intermediate residual stromal TILs in 17 (36.2%), and high residual stromal TILs in 13 (27.6%). Pathological Complete Response (pCR) was achieved in 4 (8.5%) patients. No statistically significant association was observed between residual stromal TIL category and pCR (Fisher's-exact test, p=0.36). Residual stromal TIL category demonstrated a moderate positive correlation with MPGS (Spearman's ρ=0.56, p<0.001) and a moderate negative correlation with RCB class (Spearman's ρ=-0.48, p=0.002). Notably, higher residual stromal TIL levels were observed more frequently among patients demonstrating better pathological response.

Conclusion: Residual stromal TILs demonstrated significant associations with graded pathological response following NACT but not with pCR. Routine assessment of residual stromal TILs may complement pathological response evaluation, although larger prospective studies are needed to establish their clinical utility.

Keywords: Immune biomarkers, Residual cancer burden, Tumour microenvironment

INTRODUCTION

The BC is the most common malignancy worldwide and comprises a heterogeneous group of tumours with variable biology and treatment response [1]. NACT is an integral component of treatment, particularly in locally advanced BC, as it facilitates tumour downstaging, improves operability, and enables in-vivo assessment of therapeutic response [2]. pCR is an established surrogate marker of favourable long-term outcomes, especially in triple-negative and HER2-positive BCs [3]. However, a considerable proportion of patients fail to achieve pCR and are left with residual disease, which exhibits marked heterogeneity in treatment response and prognosis. Identifying reliable biomarkers within residual tumours is therefore essential for improving post-treatment risk stratification and guiding subsequent management.

The TILs have been extensively studied as indicators of the host immune response within the tumour microenvironment and have emerged as important prognostic and predictive biomarkers in BC [4]. Among the immune components, TILs evaluated on routine H&E - stained sections have demonstrated excellent reproducibility and clinical significance [5]. Several studies have shown that pre-treatment stromal TILs are associated with higher rates of pCR and improved survival, particularly in triple-negative and HER2-positive BCs [6-8].

Residual sTILs differ biologically from pre-treatment TILs because they reflect the post-treatment immune microenvironment after chemotherapy rather than the baseline host immune response. NACT induces immunogenic cell death, enhances tumour antigen presentation, and promotes recruitment of cytotoxic lymphocytes while simultaneously selecting resistant tumour clones. Consequently, residual stromal TILs may better represent the interaction between chemotherapy-induced immune activation and residual tumour burden, explaining their significant association with graded pathological response observed in the present study.

Despite these advances, the biological and clinical significance of residual stromal TILs following completion of NACT remains incompletely understood. Unlike pre-treatment TILs, residual stromal TILs reflect the post-treatment immune landscape and may capture the dynamic interaction between chemotherapy-associated alterations in the immune microenvironment and residual tumour cells. Emerging evidence suggests that residual stromal TILs may provide additional information regarding residual disease burden and treatment response; however, available studies are limited, their findings remain inconsistent, and standardised evidence supporting their routine clinical application is still evolving, particularly in resource-constrained settings and Asian populations [9-13].

Furthermore, most published studies have primarily focused on pCR as the principal endpoint, whereas the relationship of residual stromal TILs with graded pathological response assessed using both the Miller-Payne Grading System (MPGS) and Residual Cancer Burden (RCB) classification has been inadequately explored. This represents an important knowledge gap because MPGS and RCB provide a more comprehensive assessment of tumour regression than the binary pCR outcome alone. Understanding this relationship is clinically important because residual stromal TIL assessment may improve post-NACT risk stratification and complement conventional pathological response evaluation using a simple, cost-effective biomarker that can be assessed on routine H&E-stained sections [5].

Therefore, the present study aimed to evaluate residual stromal TILs in post-NACT breast carcinoma specimens and to determine their association with pathological response using both the MPGS and RCB classification.

MATERIALS AND METHODS

This retrospective cohort study was conducted at the Department of Pathology, Sri Deveraj URS Medical College, Kolar, Karnataka, India, from January 2021 to January 2025. The study was approved by the Institutional Ethics Committee (IEC) of SDUMC with Approval Reference No: SDUAHER/R&D/CEC/SDUMC-PG/198/NF/2025-26.

Sample size: Since all eligible cases during the study period were included, consecutive sampling was performed and formal sample size calculation was not applicable.

Inclusion criteria: Patients with histologically confirmed invasive breast carcinoma diagnosed on pre-treatment core biopsy who subsequently received NACT followed by surgical resection; H&E slides for assessment of both residual TILs and pathological response were included.

Exclusion criteria: Patients were excluded if radiotherapy had been administered before surgery, or if recurrent or secondary metastatic disease was already present at the time of diagnosis.

Study Procedure

Patients received standard Institutional NACT protocols, including Anthracycline-Taxane based regimens with HER2-targeted therapy wherever indicated.

Assessment of Tumour Infiltrating Lymphocytes (TILs): Residual sTILs were evaluated on post-NACT-treated surgical specimens using routine H&E-stained sections, in accordance with the International TILs Working Group guidelines, with assessment performed by examining the entire invasive tumour area at low and high magnification. Residual sTILs were evaluated within the borders of invasive residual carcinoma across the entire tumor area, excluding areas of necrosis, fibrosis unrelated to tumor, ductal carcinoma in situ and in cases of complete pathological response/regression, TILs may be evaluated, for research purposes, within the area of regression. Residual sTILs were quantified as the percentage of stromal area occupied by mononuclear inflammatory cells. Based on the working group's previous literature on percentage involvement, TILs were divided into low (<10%), intermediate (10-50%), and high (>50%) [5].

Assessment of pathological response by MPGS and RCB: Post-NACT, the surgical specimens underwent pathological response evaluation using MPGS. MPGS uses a five-grade scale based on the percentage reduction in tumour cells, with Grade 1 {No change or minimal change in tumour cells (<10% reduction)} to Grade 5 {No identifiable residual invasive malignant cells although DCIS may be present (pCR)} [12]. pCR means there are no residual invasive cancer cells in the breast and axillary lymph nodes (ypT0/ypN0), which is in line with the usual pathological definitions [14]. The rest of the cases were all categorised as non pCR.

The RCB quantifies post-treatment residual disease by integrating primary tumour dimensions, invasive cellularity, nodal involvement, and size of nodal metastases [15]. RCB was determined according to the methodology described by Symmans WF et al., using the official online RCB calculator hosted by The University of Texas MD Anderson Cancer Center and categorised as RCB-0 (pCR), RCB-I (minimal), RCB-II (moderate), and RCB-III (extensive residual disease) [15,16].

STATISTICAL ANALYSIS

As this was an exploratory retrospective cohort study, no sample size was calculated. Demographic and pathological features were summarised using descriptive statistics. The association between different categories of sTILs and pathological response was evaluated by Fisher's-exact test (categorical associations) and Spearman's rank correlation coefficient (associations between ordinal variables). These non parametric methods are appropriate given the ordinal nature of TILs, MPGS, and RCB data and the small sample size. Statistical analysis was performed using Statistical Package for Social Sciences (IBM SPSS) version 29.0, and p-value <0.05 was considered statistically significant.

RESULTS

The present study evaluated the demographic and clinical characteristics of 47 patients with BC who underwent surgery following NACT, with a particular emphasis on the distribution of residual sTILs and their relationship to pathological response along with demographic variables.

The mean age of the cohort was 50.9±9.9 years, with a predominance of patients aged >50 years, 25 (53.2%). Tumours were more frequently right-sided 28 (59.6%). Most patients 37 (78.7%) received four cycles of NACT, with fewer undergoing extended regimens. These baseline characteristics were descriptive and were not evaluated for independent associations with treatment outcomes [Table/Fig-1].

Parameters	Variables	n (%)
Age (years)	≤ 40	8 (17)
	41 to 50	14 (29.8)
	> 50	25 (53.2)
Age (years), (Mean±SD)	50.9±9.9 years	
Tumour laterality	Right	28 (59.6)
	Left	19 (40.4)
Number of NACT cycles	4	37 (78.7)
	6	3 (6.4)
	≥ 8	7 (14.9)
Total	47 (100)	

[Table/Fig-1]: Baseline demographic and clinical characteristics of the study population.

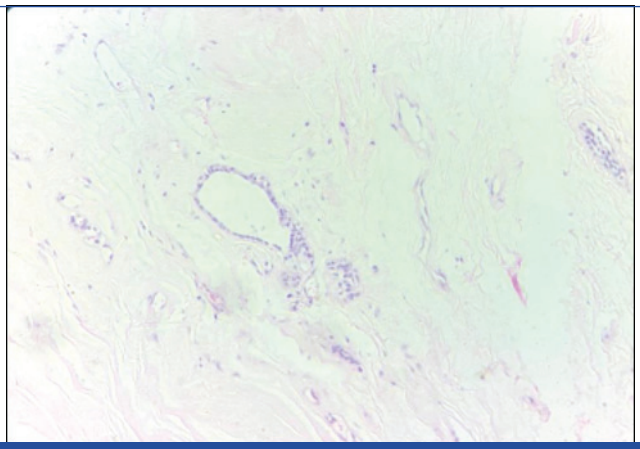
Most of the patients, 43 (91.5%) had residual disease, reflecting predominant non pCR outcomes [Table/Fig-2]. The association between residual sTILs and response to NACT was analysed using Fisher's-exact test. pCR was observed in intermediate and

high stromal TIL categories, where four patients achieved pCR. Although pCR percentages were observed in intermediate and high TIL groups, the association was not statistically significant (Fisher's-exact test, p=0.36) in the present study due to the limited sample size [Table/Fig-2].

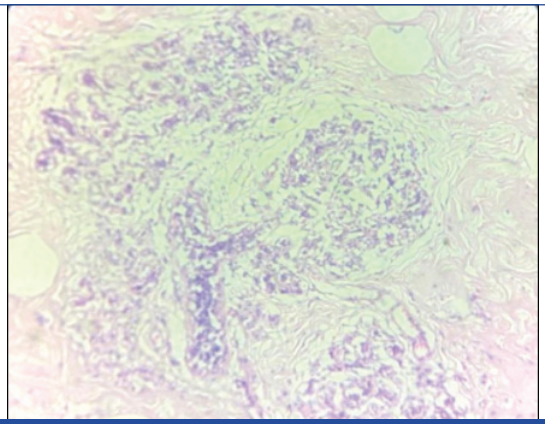
Residual sTIL Category	Number of patients	pCR	Non pCR
Low (<10%)	17 (36.2%)	0	17 (100%)
Intermediate (10 to 50 %)	17 (36.2%)	2 (11.8%)	15 (88.2%)
High (>50 %)	13 (27.6%)	2 (15.4%)	11 (84.6%)
Total	47 (100%)	4 (8.5%)	43 (91.5%)

[Table/Fig-2]: Association between residual stromal TIL categories and pathological Complete Response (pCR).
*Fisher's-exact test, p=0.36 (Statistical significance was defined as p<0.05)

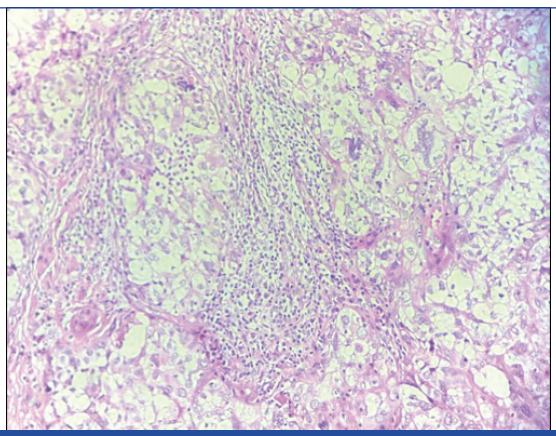
Low sTIL levels (<10%) [Table/Fig-3] were identified in 17 patients (36.2 %), intermediate sTIL levels (10 to 50%) [Table/Fig-4] in 17 patients (36.2 %), and high sTIL levels (>50%) [Table/Fig-5] in 13 patients (27.6%). Only 4 (8.5%) patients achieved pCR, indicating a low complete treatment response rate.



[Table/Fig-3]: Low TILs (H&E stain, 20X).



[Table/Fig-4]: Intermediate TILs (H&E stain, 20X).



[Table/Fig-5]: High TILs (H&E stain, 20X).

Assessment of pathological response using the MPGS showed that Grade 3 response was the most common, observed in 13 patients (27.66%), and assessment of pathological response using the RCB scoring showed that RCB-III response was the most common, observed in 24 patients (51.06%) [Table/Fig-6].

Scoring system	Grade	n (%)
Miller-Payne Score (MPS)	Grade 1	12 (25.53)
	Grade 2	11 (23.41)
	Grade 3	13 (27.66)
	Grade 4	7 (14.89)
	Grade 5	4 (8.51)
	Total	47 (100)
Residual Cancer Burden (RCB)	RCB-0	4 (8.51)
	RCB-I	1 (2.13)
	RCB-II	18 (38.30)
	RCB-III	24 (51.06)
	Total	47 (100)

[Table/Fig-6]: Distribution of Miller–Payne Grading system (MPGS) and Residual Cancer Burden (RCB).

Higher MPGS grades were associated with increasing stromal TIL levels, with low TILs predominating in lower grades (Grades 1-2) and high TILs more frequent in higher grades (Grades 3-5), suggesting a positive correlation between pathological response grade and immune infiltration. This distribution shows a progressive increase in residual sTIL density from low to high with increasing MPS grade. The present study demonstrated a significant association between the grade of MPGS and the distribution of residual sTIL where Fisher's-exact test demonstrated a statistically significant association (p=0.013). Furthermore, Spearman's rank correlation showed a moderate positive correlation between residual sTIL levels and MPGS (ρ=0.56, p<0.001), indicating that higher residual sTIL density was associated with greater pathological tumour regression [Table/Fig-7].

MPGS	Low sTILs (n)	Intermediate sTILs (n)	High sTILs (n)	Total (n)
Grade 1	7	4	1	12
Grade 2	8	2	1	11
Grade 3	2	7	4	13
Grade 4	0	2	5	7
Grade 5	0	2	2	4
Total	17	17	13	47

[Table/Fig-7]: Correlation between MPGS and stromal TIL's.
*Spearman's rho (ρ) = +0.56, p-value <0.001

Intermediate-to-high residual sTILs were more common in lower RCB grade (RCB-0/1) and less common in higher grade (RCB-3). Fisher's-exact test demonstrated a significant association between residual sTIL category and RCB class (χ^2=14.8, p=0.002). Spearman's rank correlation analysis revealed a moderate negative correlation between residual stromal TIL levels and RCB class (ρ=-0.48, p=0.002), indicating that higher residual stromal TIL density was associated with lower residual disease burden [Table/Fig-8].

RCB Grade	Low sTILs (n)	Intermediate sTILs (n)	High sTILs (n)	Total (n)
RCB-0	0	2	2	4
RCB-I	0	0	1	1
RCB-II	4	9	5	18
RCB-III	13	6	5	24
Total	17	17	13	47

[Table/Fig-8]: Correlation between RCB and residual stromal TILs.
*Spearman's rho (ρ)=-0.48, p-value=0.002

Although residual stromal TILs were not significantly associated with the binary endpoint of pCR, significant positive monotonic associations were observed with ordinal pathological response systems (MPGS and RCB).

DISCUSSION

Residual sTILs represent the host immune response within the post-treatment tumour microenvironment and have gained increasing attention as potential biomarkers following NACT. The present study evaluated residual stromal TILs in breast carcinoma following NACT and examined their association with pathological response using the MPGS and RCB.

The study population predominantly comprised women older than 50 years, with most patients receiving four cycles of NACT. Residual stromal TILs demonstrated considerable heterogeneity, with low and intermediate TIL densities each observed in 36.2% of patients. This variability is consistent with previous reports indicating that the immune microenvironment differs substantially among BCs and may be modified by chemotherapy. Standardised assessment of residual stromal TILs on routine H&E-stained sections, as recommended by the International Immuno-Oncology Biomarker Working Group, provides a reproducible and practical approach for routine pathological evaluation [5].

Only four patients (8.5%) achieved pCR. Although pCR occurred exclusively in the intermediate and high stromal TIL groups, the association between stromal TIL categories and pCR was not statistically significant (Fisher's-exact test, p=0.36). This finding should be interpreted cautiously because the small sample size and limited number of pCR cases reduce the statistical power to detect differences. Similar observations have been reported in studies demonstrating that the predictive value of TILs varies according to molecular subtype and sample size [14,17].

Conversely, residual stromal TILs had a statistically significant correlation with both MPGS and RCB. An elevation in stromal TIL density was positively associated with enhanced MPGS grades, but a negative link was noted with RCB classes, suggesting that tumours with increased immune infiltration typically had improved pathological regression and less residual disease burden. In contrast to the dichotomous outcome of pCR, both MPGS and RCB assess the entire range of treatment responses, which could elucidate their more robust correlation with residual stromal TILs in our study [15,16].

These observations are consistent with previous studies demonstrating that increased stromal TILs are associated with enhanced pathological response following NACT. Denkert C et al., reported that higher TIL levels were associated with improved response to NACT, particularly in triple-negative and HER2-positive BCs [4]. However, their pooled analysis primarily evaluated stromal TILs on pretreatment biopsy specimens, whereas the present study assessed residual stromal TILs in post-NACT surgical specimens. Residual stromal TILs represent the immune microenvironment after chemotherapy-induced tumour remodelling and therefore provide different biological information from baseline TIL assessment.

Similarly, Luen SJ et al., evaluated residual disease sTILs after NACT in triple-negative BC and demonstrated prognostic significance [14]. Our findings are in agreement with their observation that residual stromal TILs remain clinically informative after treatment. However, unlike their study, which evaluated survival outcomes, the present study assessed pathological response using the MPGS and RCB classification. The absence of a significant association with pCR in the present cohort may be attributable to the relatively small sample size, low pCR rate, inclusion of all molecular subtypes, and differences in study endpoints.

Likewise, Li S et al., reported, through a meta-analysis, that higher TIL levels were associated with improved pCR and survival following NACT [17]. Differences between their findings and the present study may reflect methodological heterogeneity, including assessment of pretreatment versus residual stromal TILs, molecular subtype distribution, treatment protocols, and statistical power.

The concordance observed between higher MPGS grades and lower RCB classes also supports the biological relationship between tumour regression and residual disease burden. Since both grading systems evaluate treatment response using different pathological parameters, their significant association with stromal TILs suggests that immune infiltration is more closely related to the overall degree of tumour regression than to complete pathological response alone. This distinction is important because many patients demonstrate substantial tumour regression without achieving pCR [18-20].

El Bairi K et al., emphasised the growing importance of immune biomarkers in precision oncology and future immunotherapeutic strategies [21]. Although immunotherapy-related biomarkers were not evaluated in the present study, the observed heterogeneity of residual stromal TILs supports the concept that routine immune profiling may provide clinically relevant information regarding the post-treatment tumour microenvironment. However, the present findings should not be interpreted as evidence of immunotherapy response and require validation in prospective studies incorporating molecular immune biomarkers.

In TNBC, stromal TILs are established prognostic and predictive biomarkers, with higher sTIL levels associated with improved pathological response and survival following NACT. Consistent with this, da Costa NC et al., reported that 55% of residual TNBCs exhibited high stromal TIL levels following NACT (p≤0.0001), supporting chemotherapy-induced immune remodelling within the tumour microenvironment [22]. Similarly, Ciarka A et al., highlighted that residual immune biomarkers remain clinically relevant for post-treatment risk stratification in patients with residual TNBC [23].

Limitation(s)

Residual stromal TIL assessment is a promising, readily available biomarker that may complement pathological evaluation, but it remains investigational and requires prospective validation. This retrospective, single-centre exploratory study was limited by a small sample size, few pCR events, absence of multivariable analysis, lack of molecular subtype classification and baseline TIL assessment, and no survival follow-up. These limitations restricted assessment of associations with pCR, dynamic immune changes after NACT, and the prognostic significance of residual stromal TILs. Larger multicentre studies incorporating paired pre- and post-NACT TIL evaluation, molecular characterisation, and long-term survival outcomes are needed to establish its clinical relevance.

CONCLUSION(S)

Residual TILs demonstrated heterogeneous distribution in breast carcinoma following NACT and were associated with favourable graded pathological response assessed using the MPGS and RCB classification. Assessment of residual stromal TILs on routine H&E-stained sections may complement conventional post-neoadjuvant pathological evaluation by providing a simple, reproducible, and cost-effective measure of the post-treatment tumour immune microenvironment. However, larger prospective multicentric studies incorporating molecular subtype stratification, paired pre- and post-treatment TILs assessment, and long-term survival outcomes are required before routine clinical implementation can be recommended.

REFERENCES

[1] Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide. CA Cancer J Clin. 2021;71(3):209-49.
[2] Mieog JS, van der Hage JA, van de Velde CJ. Neoadjuvant chemotherapy for operable breast cancer. Br J Surg. 2007;94(10):1189-200.

[3] Cortazar P, Zhang L, Untch M, Mehta K, Costantino JP, Wolmark N, et al. Pathological complete response and long-term clinical benefit in breast cancer: The CTNeoBC pooled analysis. Lancet. 2014;384(9938):164-72.
[4] Denkert C, von Minckwitz G, Darb-Esfahani S, Lederer B, Heppner BI, Weber KE, et al. Tumour-infiltrating lymphocytes and prognosis in different subtypes of breast cancer: A pooled analysis of 3771 patients treated with neoadjuvant therapy. Lancet Oncol. 2018;19(1):40-50.
[5] Dieci MV, Radosevic-Robin N, Fineberg S, van den Eynden G, Ternes N, Penault-Llorca F, et al. Update on tumor-infiltrating lymphocytes (TILs) in breast cancer, including recommendations to assess TILs in residual disease after neoadjuvant therapy and in carcinoma in situ: A report of the International Immuno-Oncology Biomarker Working Group on Breast Cancer. Semin Cancer Biol. 2018;52(Pt 2):16-25.
[6] Loi S, Sirtaine N, Piette F, Salgado R, Viale G, Van Eenoo F, et al. Prognostic and predictive value of tumour-infiltrating lymphocytes in a phase III randomized adjuvant breast cancer trial in node-positive breast cancer. J Clin Oncol. 2013;31(7):860-67.
[7] Denkert C, Loibl S, Noske A, Roller M, Müller BM, Komor M, et al. Tumour-associated lymphocytes as an independent predictor of response to neoadjuvant chemotherapy in breast cancer. J Clin Oncol. 2010;28(1):105-13.
[8] Adams S, Gray RJ, Demaria S, Goldstein L, Perez EA, Shulman LN, et al. Prognostic value of tumour-infiltrating lymphocytes in triple-negative breast cancers from two phase III randomized adjuvant breast cancer trials. J Clin Oncol. 2014;32(27):2959-66.
[9] Denkert C, von Minckwitz G, Brase JC, Sinn BV, Gade S, Kronenwett R, et al. Tumour-infiltrating lymphocytes and response to neoadjuvant chemotherapy with or without carboplatin in human epidermal growth factor receptor 2-positive and triple-negative primary breast cancers. J Clin Oncol. 2015;33(9):983-91.
[10] Pruneri G, Vingiani A, Denkert C. Tumour-infiltrating lymphocytes in early breast cancer. Breast. 2018;37:207-14.
[11] Salgado R, Denkert C, Campbell C, Savas P, Nuciforo P, Aura C, et al. Tumour-infiltrating lymphocytes and breast cancer: Clinical utility and future directions. J Natl Cancer Inst. 2023;115(1):01-09.
[12] Ogston KN, Miller ID, Payne S, Hutcheon AW, Sarkar TK, Smith I, et al. A new histological grading system to assess response of breast cancers to primary chemotherapy: Prognostic significance and survival. Breast. 2003;12(5):320-27.
[13] Issa-Nummer Y, Loibl S, von Minckwitz G, Denkert C. Tumour-infiltrating lymphocytes in breast cancer: A new predictor for responses to therapy. Oncoimmunology. 2014;3(3):e27926.
[14] Luen SJ, Salgado R, Dieci MV, Vingiani A, Curigliano G, Gould RE, et al. Prognostic implications of residual disease tumour-infiltrating lymphocytes and residual cancer burden in triple-negative breast cancer patients after neoadjuvant chemotherapy. Ann Oncol. 2019;30(2):236-42.
[15] Symmans WF, Peintinger F, Hatzis C, Rajan R, Kuerer H, Valero V, et al. Measurement of residual breast cancer burden to predict survival after neoadjuvant chemotherapy. J Clin Oncol. 2007;25(28):4414-22.
[16] Residual cancer burden calculator. Houston (TX): MD Anderson Cancer Center; 2020. https://www3.mdanderson.org/app/medcalc/index.cfm?pagename=jsconvert3.
[17] Li S, Zhang Y, Zhang P, Xue S, Chen Y, Sun L, et al. Predictive and prognostic values of tumour infiltrating lymphocytes in breast cancers treated with neoadjuvant chemotherapy: A meta-analysis. Breast. 2022;66:97-109.
[18] Ul Ain N, Ishaq S, Islam MK, Badar Q, Chaudhry K, Adil T, et al. Association of tumour-infiltrating lymphocytes (TILs) with pathological complete response to neoadjuvant therapy in breast cancer. Cureus. 2025;17(11):e96076.
[19] Dieci MV, Radosevic-Robin N, Fineberg S, van den Eynden G, Ternes N, Penault-Llorca F, et al. Update on tumour-infiltrating lymphocytes (TILs) in breast cancer, including recommendations to assess TILs in residual disease after neoadjuvant therapy and in carcinoma in situ: A report of the International Immuno-Oncology Biomarker Working Group on Breast Cancer. Semin Cancer Biol. 2018;52(Pt 2):16-25.
[20] Zhu Y, Tzoras E, Matikas A, Bergh J, Valachis A, Zerdes I, et al. Expression patterns and prognostic implications of tumour-infiltrating lymphocytes dynamics in early breast cancer patients receiving neoadjuvant therapy: A systematic review and meta-analysis. Front Oncol. 2022;12:999843.
[21] El Bairi K, Haynes HR, Blackley E, Fineberg S, Shear J, Turner S, et al. The tale of TILs in breast cancer: A report from the International Immuno-Oncology Biomarker Working Group. NPJ Breast Cancer. 2021;7(1):150.
[22] da Costa NC, Fernandes ACP, Damin APS. Prognostic relevance of increased tumour-infiltrating lymphocytes in residual TNBC following neoadjuvant chemotherapy. BMC Cancer. 2025;25(1):1856.
[23] Ciarka A, Piątek M, Pęksa R, Kunc M, Senkus E. Tumour-infiltrating lymphocytes (TILs) in breast cancer: Prognostic and predictive significance across molecular subtypes. Biomedicines. 2024;12(4):763.

PARTICULARS OF CONTRIBUTORS:
1. Junior Resident-3, Department of Pathology, Sri Deveraj URS Medical College, Kolar, Karnataka, India.
2. Professor, Department of Pathology, Sri Deveraj URS Medical College, Kolar, Karnataka, India.
3. Professor, Department of Pathology, Sri Deveraj URS Medical College, Kolar, Karnataka, India.
4. Professor and Director, Department of General Surgery, Sri Deveraj URS Medical College, Kolar, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. MS Supreetha,
Professor, Department of Pathology, Sri Deveraj URS Medical College and Hospital, Quarters, Kolar-563103, Karnataka, India.
E-mail: drsupreethavvv.2009@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jul 10, 2026
- Manual Googling: Aug 01, 2026
- iThenticate Software: Aug 04, 2026 (3%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. No

Date of Submission: **Jun 26, 2026**
Date of Peer Review: **Jul 11, 2026**
Date of Acceptance: **Aug 06, 2026**
Date of Publishing: **Sep 01, 2026**