DOI: 10.14744/cm.2026.31644
Compreh Med 2026;18(Suppl. 1):11-15

RESEARCH ARTICLE

Predictive Value of Pretreatment Inflammation-Based Prognostic Scores for Primary Non-Muscle-Invasive Bladder Cancer

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ABSTRACT

Objective: Inflammation-based prognostic scores include the neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and lymphocyte-to-monocyte ratio (LMR). These proposed biomarkers may serve as useful prognostic indicators for stratifying patients with favorable and poor prognoses. The aim of this study was to evaluate the predictive value of pretreatment prognostic scores for differentiating non-muscle-invasive bladder cancer (NMIBC) risk groups.

Materials and Methods: Data from patients who underwent transurethral resection of the tumor and were newly diagnosed with NMIBC between January 2015 and July 2018 were retrospectively analyzed. Patient demographics, tumor characteristics, and laboratory results were recorded. Patients were stratified into three risk groups (low-, intermediate-, and high-risk) according to the European Association of Urology guidelines. These three risk groups were compared in terms of NLR, PLR, and LMR.

Results: A total of 363 patients were included in the study. The numbers of patients in the low-, intermediate-, and high-risk groups were 79, 103, and 181, respectively. The mean NLR and LMR values were similar among the groups; however, the mean PLR value was significantly lower in the low-risk group (p=0.003). The PLR cutoff value was 148.3, and the area under the curve was 0.63, with a sensitivity of 52% and specificity of 81%.

Conclusion: This study demonstrated that preoperative PLR is a prognostic marker for distinguishing the low-risk group from the intermediate- and high-risk groups among patients with NMIBC. As an easily accessible marker, PLR can be integrated into current risk stratification models and may be useful in decision-making regarding treatment and follow-up planning.

Keywords: Bladder cancer, inflammatory index, lymphocyte, monocyte, platelet

How to cite this article: Güler H, Yücetaş U, Sönmezay E, Erkan E, Pazır Y, Kadıhasanoğlu M. Predictive Value of Pretreatment Inflammation-Based Prognostic Scores for Primary Non-Muscle-Invasive Bladder Cancer. Compreh Med 2026;18(Suppl. 1):11-15.

INTRODUCTION

Bladder cancer (BC), the most common malignancy of the urinary tract, is the ninth most common cancer worldwide.[1] Global data from 2020 indicate that this malignancy is associated with a high disease burden, with 573,278 new cases and 212,536 deaths annually.[2] Urothelial carcinoma is the predominant histological subtype of bladder cancer, with non-muscle-invasive bladder cancer (NMIBC) accounting for nearly 75–85% of cases at the time of clinical presentation.[3] For these patients, transurethral resection of the bladder tumor (TUR-BT) remains the gold-standard primary intervention. In addition, adjuvant intravesical treatments are recommended according to patients' risk classifications. In NMIBC, recurrence and progression rates can reach 70% and 30%, respectively, and vary widely among patients.[4] Therefore, risk tables have been developed to accurately predict

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Received date: 13.05.2026
Revised date: 12.06.2026
Accepted date: 13.06.2026
Online date: 14.10.2026

Comprehensive Medicine published by Kare Media.
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recurrence and progression and to determine individualized treatment and follow-up strategies.

The European Organisation for Research and Treatment of Cancer (EORTC) and Spanish Urological Club for Oncological Treatment (CUETO) risk tables serve as essential prognostic tools, allowing estimation of recurrence and progression probabilities based on established scoring criteria.[4,5] However, the predictive accuracy of these models is not optimal, and additional predictive markers are needed.[6]

Current evidence indicates that cancer can induce a systemic inflammatory response, resulting in alterations in circulating immune cells. The most notable changes are neutrophilia accompanied by relative lymphocytopenia or thrombocytosis. These immune cells contribute to tumor cell proliferation, differentiation, and maturation within the tumor microenvironment by releasing various cytokines and chemokines.[7] There is a well-established correlation between oncologic prognosis and various inflammation-based scores, such as the preoperative platelet-to-lymphocyte ratio (PLR), neutrophil-to-lymphocyte ratio (NLR), and lymphocyte-to-monocyte ratio (LMR). The predictive utility of these preoperative ratios has been validated across a broad spectrum of malignancies, including breast, lung, liver, and colon cancers.[8–10] In recent years, the prognostic value of inflammation-based scores in BC has been investigated in numerous studies, with varying results.[11–14] However, there is insufficient evidence regarding whether these biomarkers have prognostic value in differentiating patients with NMIBC according to risk groups.

This study aimed to assess the predictive utility of preoperative inflammation-based prognostic scores in stratifying patients with NMIBC according to risk groups.

MATERIALS and METHODS

Patients

Data from patients who underwent TUR-BT and were newly diagnosed with NMIBC at two different institutions between January 2015 and July 2018 were retrospectively analyzed. Patients with acute infection, autoimmune disease, hepatic or renal dysfunction, hematological malignancy, or other malignant diseases were excluded from the study.

Patient demographics, tumor characteristics, and laboratory results were recorded. Tumor stage was determined according to the 2002 TNM classification, and tumor grade was determined according to the 2004 World Health Organization classification system.[15,16] Based on the criteria established in the European Association of Urology (EAU) guidelines, patients were categorized into low-, intermediate-, and high-risk groups.[3] These three risk groups were compared in terms of NLR, PLR, and LMR.

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by University of Health Sciences İstanbul Training and Research Hospital Clinical Research Ethics Committee (Approval Number: 94, Date: 27.04.2026).

Blood Analysis

As part of the standard preoperative assessment, venous blood samples were obtained from all participants. These samples, collected in tubes containing ethylenediaminetetraacetic acid, underwent hematological evaluation using Sysmex XE-2100 and XE-5000 analyzers (Sysmex UK, Milton Keynes, UK). Complete blood count results obtained within 60 days before surgery were evaluated. For patients with multiple measurements, the values from the sample obtained closest to the date of surgery were used. Neutrophil, lymphocyte, monocyte, and platelet counts were obtained, and the NLR, PLR, and LMR values for each patient were calculated. NLR and PLR were calculated by dividing the neutrophil and platelet counts by the lymphocyte count, respectively. LMR was calculated by dividing the lymphocyte count by the monocyte count.

Statistical Analysis

Data were presented as means, medians (IQRs), and ranges. Data normality was assessed using the Kolmogorov-Smirnov test. For subsequent statistical analyses, the chi-square and Kruskal-Wallis tests were used, with $p<0.05$ considered statistically significant. Additionally, the optimal PLR cutoff value was determined using the Youden index and receiver operating characteristic (ROC) analysis. Statistical analyses were performed using STATA version 11.0 (StataCorp LP, College Station, TX, USA).

RESULTS

A total of 363 patients (315 men and 48 women) were evaluated, with a mean age of 64.25±10.54 years. In terms of risk distribution, the high-risk group was the largest (n=181), whereas the intermediate- and low-risk groups included 103 and 79 patients, respectively. The mean age of the low-risk group was lower than those of the intermediate- and high-risk groups (p=0.0001). Sex distribution and smoking status were similar among the groups (Table 1). The mean NLR and LMR values were also similar among the groups; however, the mean PLR value was significantly lower in the low-risk group

Table 1. Comparison of patient characteristics and pretreatment inflammation-based prognostic scores among the risk groups

Variable	Low-risk group (n=79)	Intermediate-risk group (n=103)	High-risk group (n=181)	p
Age (years), mean±SD	58.3±10.1	64.5±9.9	66.6±9.5	0.0001*
Sex (male/female)	70/9	88/14	156/24	0.9
Smoking status (smokers/non-smokers)	50/7	68/7	123/14	0.8
NLR, median (IQR)	2.26 (1.46)	2.28 (1.48)	2.3 (1.9)	0.6
LMR, median (IQR)	3.89 (2.13)	3.79 (1.78)	3.48 (2.28)	0.7
PLR, median (IQR)	102 (49)	118 (63)	124 (69)	0.003*

*: p<0.05, statistically significant. IQR: interquartile range; LMR: lymphocyte-to-monocyte ratio; NLR: neutrophil-to-lymphocyte ratio; PLR: platelet-to-lymphocyte ratio; SD: standard deviation.

(p=0.003) (Table 1). For predicting the low-risk group, the PLR cutoff value was 148.3, and the area under the curve was 0.63, with a sensitivity of 52% and specificity of 81% (Fig. 1).

DISCUSSION

In the present study, we evaluated the value of three pretreatment inflammation-based prognostic scores (PLR, NLR, and LMR) in predicting NMIBC risk groups. Our results revealed that PLR was significantly lower in patients with low-risk NMIBC than in those in the intermediate- and high-risk groups. Conversely, neither NLR nor LMR showed significant differences among the risk categories in our study population. To the best of our knowledge, the current literature lacks prior research specifically exploring the association between PLR and risk group classification in NMIBC.

The clinical management of bladder cancer is complex because of its inherent biological heterogeneity, requiring precise staging and risk assessment to tailor therapeutic interventions. Although histopathological examination remains the definitive diagnostic tool, staging discrepancies are common; evidence suggests that nearly half of patients undergoing radical cystectomy may have been incorrectly staged preoperatively.[17,18] In recent years, efforts have focused on improving staging accuracy by integrating histopathological findings with imaging modalities, such as computed tomography and magnetic resonance imaging, as well as molecular biomarkers into predictive nomograms.[19,20] Although several such models incorporating molecular parameters have been developed, there remains a need to include additional variables, particularly laboratory-based markers, to further improve their predictive performance.

Accumulating evidence indicates that the host inflammatory response plays a key role in carcinogenesis, as well as in tumor growth and progression.[7,21] Neutrophils and platelets, which are important components of the immune system, have inhibitory effects on antitumor activity. In contrast, lymphocytes have an activating effect. Lymphocytes contribute to the host's antitumor immunity by mediating cytotoxic cell death and inhibiting tumor cell proliferation and metastasis. Reduced lymphocyte counts weaken the host's antitumor immune response, thereby increasing the likelihood of cancer recurrence and progression.[22,23] Conversely, platelets facilitate tumor angiogenesis by releasing proangiogenic factors and also contribute to protecting tumor cells from cytolytic destruction.[24,25] Monocytes can increase the number of tumor-associated macrophages, which may contribute to tumor growth and metastasis and therefore reflect tumor burden.[26] Additionally, it has been suggested that neutrophilia promotes tumor growth and progression by increasing inflammatory mediators such as proangiogenic factors (VEGF), proteases, growth factors (CXCL8), and antiapoptotic markers (NF-κB).[27] Therefore,

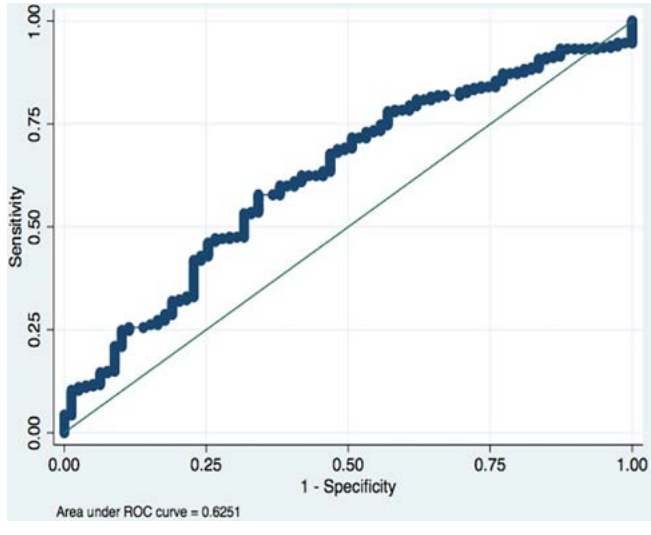

Figure 1. ROC curve of platelet-lymphocyte ratio to predict low-risk group

ROC: Receiver operating characteristic

the numbers of these immune cells and their ratios to one another may reflect the host immune response and serve as predictive markers of cancer prognosis.

In the present study, our findings showed that preoperative PLR has predictive value in distinguishing the low-risk NMIBC group from the intermediate- and high-risk groups. Similarly, previous studies involving patients with NMIBC reported that higher preoperative PLR was associated with higher tumor grade and lamina propria invasion.[28,29] Supporting our findings, tumor grade and lamina propria invasion are among the parameters used to stratify patients with NMIBC into risk groups. Furthermore, Wang et al.'s[30] meta-analysis of 3,303 patients with BC revealed that lower PLR was associated with better overall survival. Taken together, PLR may be considered a low-cost prognostic marker for distinguishing patients with NMIBC according to risk group and can be easily assessed before surgery.

The majority of studies investigating the prognostic significance of preoperative inflammatory markers in NMIBC and MIBC have shown that high NLR and low LMR are associated with worse oncologic outcomes. Several studies have reported that high NLR levels are associated with muscle-invasive disease at TUR-BT. Furthermore, Viers et al.[31] reported an increased risk of extravesical disease extension and lymph node metastasis in patients with higher NLR. In their meta-analysis, Tang et al.[32] included studies involving both NMIBC and muscle-invasive bladder cancer (MIBC) and concluded that high NLR was associated with poorer overall survival (OS), cancer-specific survival (CSS), recurrence-free survival (RFS), and progression-free survival. Regarding LMR, Adamkiewicz et al.[33] reported that LMR was an independent predictor of progression in patients with NMIBC receiving intravesical BCG therapy. Moreover, Ma et al.'s[34] meta-analysis revealed that lower LMR was associated with worse OS, CSS, and RFS in patients with MIBC. However, in the present study, preoperative NLR and LMR had no predictive value in distinguishing patients with NMIBC according to risk group. In addition to its statistical significance, the clinical applicability of PLR deserves consideration. Since a complete blood count is routinely obtained before TUR-BT, PLR can be calculated without additional cost or patient burden. Therefore, PLR may serve as a practical adjunctive marker to support current risk stratification systems, particularly in situations in which pathological risk assessment is uncertain or additional prognostic information is desired.

The limitations of this study include its retrospective design and comparatively small sample size. Furthermore, because survival data were not available, we could not analyze the relationship between inflammation-based prognostic scores and long-term oncological outcomes such as recurrence, progression, cancer-specific survival, or overall survival. Another limitation is that inflammatory markers were assessed using a single preoperative blood sample, which may not fully reflect dynamic changes in systemic inflammatory status over time. In addition, although patients with active inflammatory conditions were excluded, residual confounding factors affecting blood cell counts cannot be completely ruled out. Therefore, prospective multicenter studies with larger cohorts and long-term follow-up are warranted to validate our findings.

CONCLUSION

This study demonstrated that preoperative PLR is a prognostic marker for distinguishing the low-risk group from the intermediate- and high-risk groups among patients with NMIBC. As an easily accessible and inexpensive biomarker, PLR may complement existing clinicopathological risk stratification systems and contribute to individualized treatment and surveillance strategies. Nevertheless, the relatively modest discriminative performance observed in the present study indicates that PLR should be considered an adjunct rather than a standalone predictor. Further prospective studies are needed before its routine incorporation into clinical practice.

Disclosures

Ethics Committee Approval: The study was approved by the University of Health Sciences İstanbul Training and Research Hospital Clinical Research Ethics Committee (No: 94, Date: 27/04/2026).

Informed Consent: The requirement for informed consent was waived by the ethics committee due to the retrospective nature of the study.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study received no financial support.

Use of AI for Writing Assistance: No use of AI-assisted technologies was declared by the authors.

Author Contributions: Concept – H.G.; Design – Y.P.; Supervision – M.K.; Funding – E.S., E.E.; Materials – U.Y., Y.P.; Data collection and/or processing – H.G.; Data analysis and/or interpretation – H.G., E.E.; Literature search – U.Y., E.S.; Writing – H.G., Y.P.; Critical review – M.K.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Siegel R, Ma J, Zou Z, Jemal A. Cancer statistics, 2014. CA Cancer J Clin 2014;64:9–29. Erratum in: CA Cancer J Clin 2014;64:364. [CrossRef]
2. 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 for 36 Cancers in 185 Countries. CA Cancer J Clin 2021;71:209–49. [CrossRef]
3. Babjuk M, Burger M, Capoun O, Cohen D, Compérat EM, Dominguez Escrig JL, et al. European Association of Urology Guidelines on Non-muscle-invasive Bladder Cancer (Ta, T1, and Carcinoma in Situ). Eur Urol 2022;81:75–94. [CrossRef]
4. Sylvester RJ, van der Meijden AP, Oosterlinck W, Witjes JA, Bouffioux C, Denis L, et al. Predicting recurrence and progression in individual patients with stage Ta T1 bladder cancer using EORTC risk tables: a combined analysis of 2596 patients from seven EORTC trials. Eur Urol 2006;49:466–5; discussion 475–7. [CrossRef]
5. Fernandez-Gomez J, Madero R, Solsona E, Unda M, Martinez-Piñeiro L, Gonzalez M, et al. Predicting nonmuscle invasive bladder cancer recurrence and progression in patients treated with bacillus Calmette-Guerin: the CUETO scoring model. J Urol 2009;182:2195–203. [CrossRef]
6. Soukup V, Čapoun O, Cohen D, Hernández V, Burger M, Compérat E, et al. Risk Stratification Tools and Prognostic Models in Non-muscle-invasive Bladder Cancer: A Critical Assessment from the European Association of Urology Non-muscle-invasive Bladder Cancer Guidelines Panel. Eur Urol Focus 2020;6:479–89. [CrossRef]
7. Coussens LM, Werb Z. Inflammation and cancer. Nature 2002;420:860–7. [CrossRef]
8. Kumar R, Geuna E, Michalarea V, Guardascione M, Naumann U, Lorente D, et al. The neutrophil-lymphocyte ratio and its utilisation for the management of cancer patients in early clinical trials. Br J Cancer 2015;112:1157–65. [CrossRef]
9. Roxburgh CS, McMillan DC. Role of systemic inflammatory response in predicting survival in patients with primary operable cancer. Future Oncol 2010;6:149–63. [CrossRef]
10. Zhou X, Du Y, Huang Z, Xu J, Qiu T, Wang J, et al. Prognostic value of PLR in various cancers: a meta-analysis. PLoS One 2014;9:e101119. [CrossRef]
11. Mano R, Baniel J, Shoshany O, Margel D, Bar-On T, Nativ O, et al. Neutrophil-to-lymphocyte ratio predicts progression and recurrence of non-muscle-invasive bladder cancer. Urol Oncol 2015;33:67.e1–7. [CrossRef]
12. D'Andrea D, Moschini M, Gust K, Abufaraj M, Özsoy M, Mathieu R, et al. Prognostic Role of Neutrophil-to-Lymphocyte Ratio in Primary Non-muscle-invasive Bladder Cancer. Clin Genitourin Cancer 2017;15:e755–64. [CrossRef]
13. Krane LS, Richards KA, Kader AK, Davis R, Balaji KC, Hemal AK. Preoperative neutrophil/lymphocyte ratio predicts overall survival and extravesical disease in patients undergoing radical cystectomy. J Endourol 2013;27:1046–50. [CrossRef]
14. Ceylan C, Doluoglu OG, Keleş I, Gazel E, Temuçin T, Odabaş Ö, et al. Importance of the neutrophil-to-lymphocyte ratio in muscle-invasive and non-muscle invasive bladder tumors. Urologia 2014;81:120–4. [CrossRef]
15. Montironi R, Lopez-Beltran A. The 2004 WHO classification of bladder tumors: a summary and commentary. Int J Surg Pathol 2005;13:143–53. [CrossRef]
16. Edge SB, Compton CC. The American Joint Committee on Cancer: the 7th edition of the AJCC cancer staging manual and the future of TNM. Ann Surg Oncol 2010;17:1471–4. [CrossRef]
17. Shariat SF, Palapattu GS, Karakiewicz PI, Rogers CG, Vazina A, Bastian PJ, et al. Discrepancy between clinical and pathologic stage: impact on prognosis after radical cystectomy. Eur Urol 2007;51:137–49; discussion 149–51. [CrossRef]
18. Ark JT, Keegan KA, Barocas DA, Morgan TM, Resnick MJ, You C, et al. Incidence and predictors of understaging in patients with clinical T1 urothelial carcinoma undergoing radical cystectomy. BJU Int 2014;113:894–9. [CrossRef]
19. Karakiewicz PI, Shariat SF, Palapattu GS, Gilad AE, Lotan Y, Rogers CG, et al. Nomogram for predicting disease recurrence after radical cystectomy for transitional cell carcinoma of the bladder. J Urol 2006;176:1354–61; discussion 1361–2. [CrossRef]
20. Margel D, Harel A, Yossepowitch O, Baniel J. A novel algorithm to improve pathologic stage prediction of clinically organ-confined muscle-invasive bladder cancer. Cancer 2009;115:1459–64. [CrossRef]
21. Mantovani A, Allavena P, Sica A, Balkwill F. Cancer-related inflammation. Nature 2008;454:436–44. [CrossRef]
22. Pfeffer CM, Singh ATK. Apoptosis: A Target for Anticancer Therapy. Int J Mol Sci 2018;19:448. [CrossRef]
23. Zou Y, Xie J, Zheng S, Liu W, Tang Y, Tian W, et al. Leveraging diverse cell-death patterns to predict the prognosis and drug sensitivity of triple-negative breast cancer patients after surgery. Int J Surg 2022;107:106936. [CrossRef]
24. Sierko E, Wojtukiewicz MZ. Platelets and angiogenesis in malignancy. Semin Thromb Hemost 2004;30:95–108. [CrossRef]
25. Sierko E, Wojtukiewicz MZ. Inhibition of platelet function: does it offer a chance of better cancer progression control? Semin Thromb Hemost 2007;33:712–21. [CrossRef]
26. Galdiero MR, Bonavita E, Barajon I, Garlanda C, Mantovani A, Jaillon S. Tumor associated macrophages and neutrophils in cancer. Immunobiology 2013;218:1402–10. [CrossRef]
27. Paramanathan A, Saxena A, Morris DL. A systematic review and meta-analysis on the impact of pre-operative neutrophil lymphocyte ratio on long term outcomes after curative intent resection of solid tumours. Surg Oncol 2014;23:31–9. [CrossRef]
28. Chen H, Wu X, Wen Z, Zhu Y, Liao L, Yang J. The Clinicopathological and Prognostic Value of NLR, PLR and MLR in Non-Muscular Invasive Bladder Cancer. Arch Esp Urol 2022;75:467-71. [CrossRef]
29. Atik YT, Cimen HI, Gul D, Arslan S, Kose O, Halis F. Are the preoperative neutrophil/lymphocyte ratio and platelet/lymphocyte ratio predictive for lamina propria invasion in aging patients? Aging Male 2020;23:1528–32. [CrossRef]
30. Wang X, Ni X, Tang G. Prognostic Role of Platelet-to-Lymphocyte Ratio in Patients With Bladder Cancer: A Meta-Analysis. Front Oncol 2019;9:757. [CrossRef]
31. Viers BR, Boorjian SA, Frank I, Tarrell RF, Thapa P, Karnes RJ, et al. Pretreatment neutrophil-to-lymphocyte ratio is associated with advanced pathologic tumor stage and increased cancer-specific mortality among patients with urothelial carcinoma of the bladder undergoing radical cystectomy. Eur Urol 2014;66:1157–64. [CrossRef]
32. Tang X, Du P, Yang Y. The clinical use of neutrophil-to-lymphocyte ratio in bladder cancer patients: a systematic review and meta-analysis. Int J Clin Oncol 2017;22:817–25. [CrossRef]
33. Adamkiewicz M, Bryniarski P, Kowalik M, Burzyński B, Rajwa P, Paradysz A. Lymphocyte-to-Monocyte Ratio Is the Independent Prognostic Marker of Progression in Patients Undergoing BCG-Immunotherapy for Bladder Cancer. Front Oncol 2021;11:655000. [CrossRef]
34. Ma JY, Hu G, Liu Q. Prognostic Significance of the Lymphocyte-to-Monocyte Ratio in Bladder Cancer Undergoing Radical Cystectomy: A Meta-Analysis of 5638 Individuals. Dis Markers 2019;2019:7593560. [CrossRef]