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The Relationship Between Pre-Treatment Inflammatory Markers and Mandard Tumor Regression Scale in Operated Locally Advanced Rectal Adenocarcinoma Patients Treated with Neoadjuvant Chemoradiotherapy

Neoadjuvan Kemoradyoterapi ile Tedavi Edilen Lokal İleri Rektal Adenokarsinom Hastalarında Tedavi Öncesi Enflamatuar Belirteçler ile Mandard Tümör Regresyon Ölçeği Arasındaki İlişki

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ABSTRACT

Background: To evaluate the relationship between pre-treatment inflammatory markers and Mandard tumor regression grade in locally advanced rectal cancer (LARC) patients who underwent surgery after neoadjuvant chemoradiotherapy (nCRT).

Materials and Methods: This single-center study included patients who underwent nCRT followed by curative surgery for rectal adenocarcinoma between 2015 and 2022. The relationship between pre-treatment neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), lymphocyte-to-monocyte ratio (LMR), neutrophil-to-eosinophil ratio (NER), hemoglobin to red blood cell distribution width ratio (Hb/RDW), and derived NLR (dNLR) values and the Mandard tumor regression grade was analyzed using the Pearson correlation test.

Results: Seventy-one patients with rectal adenocarcinoma who underwent curative surgery after nCRT between 2015 and 2022 were evaluated. Mean age was 56.6 ± 13.6 (20-82) years. Stage 3 disease was present in 88.7% of patients. Low anterior resection was performed in 60.6% of patients, and abdominoperineal resection was performed in 39.4%. A good response (Mandard grade 1, 2) was achieved in 52.1% of cases. Among inflammatory markers, only NLR showed a significant positive correlation with the Mandard grade (r = 0.320; p = 0.032). No significant correlation was found with PLR, LMR, NER, Hb/RDW, and dNLR.

Conclusion: Lower NLR values are associated with improved pathological response. NLR may serve as a simple and inexpensive marker to predict treatment response in LARC patients operated on after nCRT.

Keywords: Rectal cancer, neoadjuvant chemoradiotherapy, neutrophil-to-lymphocyte ratio, Mandard tumor regression grade

ÖZ

Amaç: Neoadjuvan kemoradyoterapi (nKRT) sonrası opere edilen lokal ileri evre rektum kanseri (LİERK) hastalarında tedavi öncesi nötrofil/lenfosit oranı (NLR) ile Mandard tümör regresyon skalası arasındaki ilişkiyi değerlendirmek amaçlandı.

Gereç ve Yöntemler: Bu tek merkezli çalışma, 2015 ile 2022 yılları arasında rektal adenokarsinom için nCRT ve ardından küratif cerrahi uygulanan hastaları içermektedir. Tedavi öncesi, NLR, trombosit-lenfosit oranı (PLR), lenfosit-monosit oranı (LMR), nötrofil-eozinofil oranı (NER), hemoglobin-kırmızı kan hücrelerinin boyut genişliği oranı (Hb/RDW) ve derive NLR (dNLR) değerleri ile Mandard tümör regresyon skalası arasındaki ilişki Pearson korelasyon testi ile analiz edildi.

Bulgular: 2015-2022 yılları arasında nKRT sonrası küratif cerrahi uygulanan 71 rektum adenokanser hastası değerlendirildi. Hastaların yaş ortalaması 56,6 ± 13,6 (20-82) idi. Hastaların %88,7'si evre 3 idi. Low anterior rezeksiyon %60,6, abdominoperineal rezeksiyon

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ÖZ

%39,4 oranında uygulandı. Mandard grade 1, 2 (iyi yanıt) %52,1 oranında saptandı. Enflamatuar markerlar değerlendirildiğinde sadece NLR ile Mandard skalası arasında anlamlı pozitif korelasyon saptandı (r = 0,320; p = 0,032). PLR, LMR, NER, Hb/RDW ve dNLR ile anlamlı ilişki bulunmadı.

Sonuç: Düşük NLR değerleri daha iyi patolojik yanıt ile ilişkilidir. NLR, nKRT sonrası opere edilen LİERK hastalarında tedavi yanıtını öngörmede kullanılabilecek basit ve ucuz bir belirteç olabilir.

Anahtar Kelimeler: Rektum kanseri, neoadjuvan kemoradyoterapi, nötrofil/lenfosit oranı, Mandard tümör regresyon skalası

Introduction

Colorectal cancer is one of the most common cancers and the leading cause of cancer-related deaths (1). Rectal cancer constitutes approximately one-third of colorectal cancers and requires different treatment approaches than those for colon cancer because of its anatomical location. Locally advanced rectal cancer (LARC) includes clinically T3-T4 and/or lymph node positive (N+) disease and treatment strategies in this patient group have undergone significant changes in recent years (2).

The standard treatment for LARC is neoadjuvant chemoradiotherapy (nCRT). This treatment modality reduces local recurrence rates to 5-10%, increases the chance of sphincter-sparing surgery by providing tumor shrinkage, and allows complete pathological response in some patients (3,4). Recent studies such as RAPIDO and PRODIGE 23 have shown that total neoadjuvant therapy (TNT) approach increases pathologic complete response rates and reduces the risk of distant metastasis compared to standard nCRT (5,6).

Evaluation of pathologic response to neoadjuvant treatment is critical for prognostication and for decisions regarding adjuvant therapy. The Mandard tumor regression scale was defined for esophageal cancer in 1994 and is now widely used in gastrointestinal malignancies including rectal cancer (7). This five-step system evaluates the ratio of fibrosis to residual tumor cells in the resection material. Grade 1 indicates a complete pathologic response, and Grade 5 indicates treatment non-response. Studies have shown that patients with Mandard grade 1, 2 (good response) have a better prognosis (8,9).

The role of the systemic inflammatory response in tumor development, progression, and treatment response has been intensively investigated in recent years. In particular, the neutrophil/lymphocyte ratio (NLR) stands out as an inexpensive indicator of systemic inflammation. Meta-analyses have confirmed that high NLR values are associated with poor prognosis in many solid tumors (10,11). It has also been reported that high NLR is associated with low pathologic response rates and short survival times in rectal cancer patients undergoing neoadjuvant treatment (12-14).

In this study, we aimed to evaluate the relationship between pretreatment NLR and other inflammatory markers (platelet-to-lymphocyte ratio (PLR), lymphocyte-to-monocyte ratio (LMR), neutrophil-to-eosinophil ratio (NER), hemoglobin to red blood cell distribution width ratio (Hb/RDW), derived NLR (dNLR) and the Mandard tumor regression scale in LARC patients who underwent surgery after nCRT.

Materials and Methods

This retrospective study obtained ethical approval from the Gaziantep City Hospital Ethics Committee (decision number: 82/2024, date: 16.10.2024). Since the study was retrospective, patient consent was not required. This single-center study included patients who underwent nCRT followed by curative surgery for rectal adenocarcinoma between 2015 and 2022. All patients received pelvic radiotherapy delivered using a linear accelerator. Radiotherapy doses ranged from 45 to 56 Gy, and concurrent fluoropyrimidine-based chemotherapy was administered. Patients who were evaluated using appropriate imaging modalities 6-10 weeks after completion of radiotherapy underwent surgery according to the principles of total mesorectal excision.

Values of NLR, PLR, LMR, NER, Hb/RDW, and dNLR were calculated before nCRT. Pathological response was evaluated according to the Mandard tumor regression scale (Table 1). Because tumor regression grade was not routinely reported in the pathology records of patients treated in the earlier years of the study period, Mandard grading could be performed only in those patients whose pathology reports or archived specimens allowed retrospective scoring.

Statistical Analysis

Analyses were performed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). The conformity of the data to a normal distribution was evaluated using the Kolmogorov-Smirnov test. Normally distributed continuous variables were expressed as mean ± standard deviation and non-normally distributed variables were expressed as median

(minimum-maximum). Categorical variables were presented as numbers and percentages. Student's t-test or the Mann-Whitney U test was used to compare two groups for continuous variables, depending on whether the variables were normally distributed. Pearson's chi-square test or Fisher's exact test was used to compare categorical variables. The relationship between inflammatory markers and the Mandard tumor regression scale was evaluated using Pearson correlation analysis. In the evaluation of the correlation coefficient (r), values of 0.00-0.29 were considered weak correlations, 0.30-0.69 moderate correlations, and 0.70-1.00 strong correlations. Receiver operating characteristic (ROC) curve analysis was performed to assess the ability of NLR to discriminate between a poor pathological response (Mandard grade 3-5) and a good response (grade 1, 2), and the area under the curve (AUC) with a 95% confidence interval was calculated. The optimal NLR cut-off value was determined using the Youden index, and the corresponding sensitivity and specificity were reported. A value of $p < 0.05$ was considered statistically significant in all analyses.

Results

The study included 71 patients with rectal adenocarcinoma who underwent curative surgery after receiving nCRT. Patient characteristics are summarized in Table 2. The mean age was 56.6 ± 13.6 years (20-82) and the median follow-up period was 10 months (6-116). 88.7% (n = 63) of the patients were in clinical stage 3. The mean primary tumor size was 6.9 ± 2.6 cm (2-15). The most common radiotherapy regimen was 50.4 Gy/28 fractions, occurring in 50.7% of cases. Surgical procedures performed were low anterior resection in 60.6% (n = 43) and abdominoperineal resection in 39.4% (n = 28).

Forty-eight patients (67.6%) were evaluated using the Mandard tumor regression scale. Pathologic complete response (grade 1) was 22.9% (n = 11); grade 2 was 29.2% (n = 14); grade 3 was 31.2% (n = 15); grade 4 was 14.6% (n = 7); and grade 5 was 2.1% (n = 1). Good response (grade 1, 2) was observed in 52.1% (n = 25), and poor response (grade 3-5) in 47.9% (n = 23).

The values of inflammatory markers are shown in Table 3. Mean NLR was 3.62 ± 3.81 (1.3-29.0), PLR 181.9 ± 99.9 (50-562), LMR 3.54 ± 1.7 3 (0.7-10.3), NER 129.3 ± 267.6 (8.3-1450), Hb/RDW 0.87 ± 0.31 (0.3-1.4), dNLR 2.37 ± 2.32 (1.0-18.0).

Analysis of the association between inflammatory markers and the Mandard tumor regression scale showed that only NLR was significantly positively correlated with the Mandard scale (r = 0.320; p = 0.032). High NLR values were associated with a high Mandard grade (poor response). PLR (p = 0.187), LMR (p = 0.439), NER (p = 0.098), Hb/RDW (p = 0.837), and dNLR (p = 0.056) were not significantly correlated with the Mandard scale. Age (r = -0.069; p = 0.639) and tumor size (r = 0.013; p = 0.932) were not significantly correlated with the Mandard scale. In ROC curve analysis, NLR showed limited discriminative ability to distinguish poor pathological response (Mandard grade 3-5) from good

Table 1. Mandard tumor regression scale.

Grade	Definition
1	Complete regression (fibrosis, no residual cancer cells)
2	Rare residual cancer cells in fibrosis
3	Fibrosis more than residual cancer cells
4	Residual cancer cells more than fibrosis
5	No regression

Table 2. Patient characteristics.

Variable	Value
Number of patients	71
Age (years)	56.6 ± 13.6 (20-82)
Follow-up duration (months)	10 (6-116)
Primary tumor size (cm)	6.9 ± 2.6 (2-15)
Clinical stage, n (%)	
Stage 2	8 (11.3)
Stage 3	63 (88.7)
Radiotherapy dose, n (%)	
50,4 Gy/28 fr	36 (50.7)
45 Gy/25 fr	21 (29.6)
54 Gy/27 fr	8 (11.3)
Others	6 (8.4)
Surgery type, n (%)	
LAR	43 (60.6)
APR	28 (39.4)

LAR, low anterior resection; APR, abdominoperineal resection.

Table 3. Inflammatory marker values and correlation with Mandard scale.

Marker	n	Mean ± SD	r value	p value
NLR	45	3.62 ± 3.81	0.320	**0.032***
PLR	45	181.9 ± 99.9	0.200	0.187
LMR	45	3.54 ± 1.73	-0.118	0.439
NER	46	129.3 ± 267.6	0.247	0.098
Hb/RDW	39	0.87 ± 0.31	0.034	0.837
dNLR	45	2.37 ± 2.32	0.288	0.056

*p < 0.05 statistically significant. NLR, neutrophil/lymphocyte ratio; PLR, platelet/lymphocyte ratio; LMR, lymphocyte/monocyte ratio; NER, neutrophil/eosinophil ratio; Hb/RDW, hemoglobin/red cell distribution width; dNLR, derived neutrophil/lymphocyte ratio, SD, standard deviation.

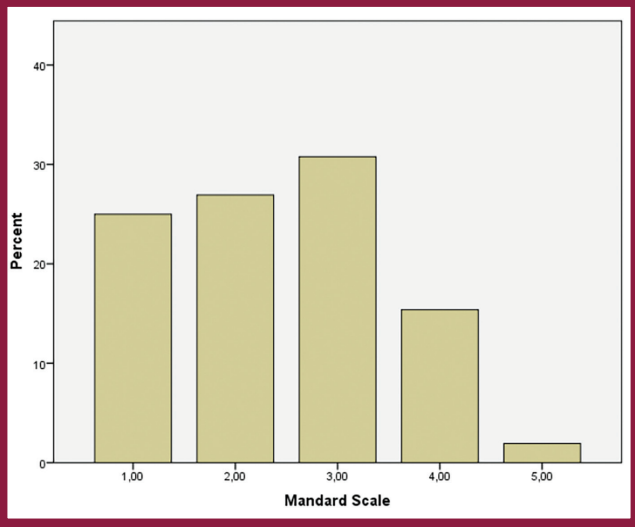


Figure 1. Receiver operating characteristic curve of pre-treatment neutrophil-to-lymphocyte ratio for predicting poor pathological response (Mandard grade 3-5). The area under the curve was 0.59 (95% confidence interval: 0.41-0.76). The optimal cut-off value determined by the Youden index was 4.8 (sensitivity 41%, specificity 88%).

response (AUC = 0.59; 95% CI 0.41-0.76). The optimal NLR cut-off value identified by the Youden index was 4.8, with a sensitivity of 41% and a specificity of 88% (Figure 1).

Discussion

We found that pretreatment NLR was significantly positively correlated with the Mandard tumor regression scale in LARC patients who underwent surgery after nCRT. Patients with low NLR values had a better pathologic response, whereas patients with high NLR values had a poorer pathologic response. No significant correlation was found between other inflammatory markers (PLR, LMR, NER, Hb/RDW, dNLR) and the Mandard scale.

The impact of the systemic inflammatory response on tumor biology is now well established. Chronic inflammation promotes tumor cell proliferation, angiogenesis, invasion and metastasis. Neutrophils in the tumor microenvironment may exert both antitumor and protumor effects, depending on the tumor stage. High neutrophil count and low lymphocyte count reflect inadequate antitumor immune response and this is associated with treatment resistance (15,16). Neutrophils contribute to tumor progression by secreting pro-angiogenic factors such as vascular endothelial growth factor and matrix metalloproteinases in the tumor microenvironment. Lymphocytes are essential components of the antitumor immune response, and low lymphocyte counts reflect immune suppression.

The prognostic and predictive value of NLR in rectal cancer has been shown in many studies. Kim et al. (14) reported that a pre-treatment NLR >2.77 significantly decreased the pathologic complete response rate in 140 rectal cancer patients undergoing nCRT. Similarly, Shen et al. (17) showed that pre-nCRT NLR >2.565 was associated with poor prognosis. Krauthamer et al. (18) reported that high NLR values were associated with poor response to nCRT. In our study, the mean NLR was 3.62, which is consistent with the threshold values reported in the literature.

In our study, 22.9% of patients had a pathologic complete response (Mandard grade 1), and 52.1% had a good response (grade 1, 2). These rates are consistent with standard nCRT results reported in the literature. Rödel et al. (8) reported good pathologic response in approximately 50% of patients in the CAO/ARO/AIO-94 study. Pathologic complete response rates increased to 28% and 27.5% with the TNT approach in the RAPIDO and PRODIGE 23 studies (5,6). The consistency of the pathological response rates in our study with those reported in the literature supports the appropriateness of our patient selection and treatment protocols.

In our study, no significant correlations were found between the Mandard scale and PLR, LMR, NER, Hb/RDW, or dNLR. However, the p-value for dNLR (0.056) approaches borderline significance and may require evaluation in larger patient populations. Although Li et al. (19) reported that LMR is an independent prognostic factor in rectal cancer, there are inconsistent results regarding its relationship with treatment response. Zou et al. (20) showed that PLR has a lower prognostic value than NLR in colorectal cancer. These findings suggest that NLR may be a more reliable predictive factor than other inflammatory markers. Although NLR was significantly correlated with the Mandard grade as a continuous variable, its discriminative ability as a dichotomous classifier distinguishing good from poor response was limited in ROC analysis (AUC = 0.59). This indicates that, in our cohort, NLR alone is not sufficient to reliably predict an individual patient's pathological response and should be interpreted as one component of a broader risk assessment rather than as a stand-alone predictive test. The proposed cut-off value of 4.8 had high specificity (88%) but low sensitivity (41%), suggesting that high pre-treatment NLR values may help identify a subgroup at risk of poor response, whereas low values do not exclude it.

Study Limitations

This study has some limitations. The main limitations are the retrospective design, single-center experience, and relatively small sample size. Although an exploratory ROC-based cut-off was identified for NLR, its modest

discriminative performance (AUC = 0.59) indicates that this threshold requires external validation before clinical use. Optimal cut-off values for the other inflammatory markers were not determined. The limited number of patients (67.6%) in whom Mandard grade assessment could be performed is also a limitation. However, the simplicity, low cost, and ready availability of NLR in routine practice make its clinical use attractive. As a non-invasive marker, NLR may be helpful in pretreatment risk stratification, and patients with high NLR values may be considered for treatment intensification or closer follow-up.

Conclusion

A significant positive correlation exists between pretreatment NLR and the Mandard tumor regression scale in patients with LARC who underwent surgery after neoadjuvant chemoradiotherapy. L ower NLR values are associated with better pathologic response, suggesting that this simple and inexpensive marker may contribute to pretreatment risk assessment; however, its limited discriminative ability in ROC analysis indicates that it should be used as part of a multifactorial evaluation rather than as a stand-alone predictor. Treatment intensification or alternative strategies may be considered in patients with high NLR values. These findings need to be confirmed by prospective, multicenter studies in larger patient populations.

Ethics

Ethics Committee Approval: This retrospective study obtained ethical approval from the Gaziantep City Hospital Ethics Committee (decision number: 82/2024, date: 16.10.2024).

Informed Consent: Since the study was retrospective, patient consent was not required.

Footnotes

Authorship Contributions

Surgical and Medical Practices: S.U.A., M.S., Concept: S.U.A., M.S., Design: S.U.A., M.S., Data Collection or Processing: S.U.A., M.S., Analysis or Interpretation: S.U.A., M.S., Literature Search: S.U.A., M.S., Writing: S.U.A., M.S.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. Siegel RL, Wagle NS, Cercek A, Smith RA, Jemal A. Colorectal cancer statistics, 2023. CA Cancer J Clin. 2023;73:233-254. [Crossref]
2. Glynne-Jones R, Wyrwicz L, Tiret E, Brown G, Rödel C, Cervantes A, et al. Rectal cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. Ann Oncol. 2017;28:iv22-iv40. [Crossref] Erratum in: Ann Oncol. 2018;29:iv263. [Crossref]
3. Sauer R, Becker H, Hohenberger W, Rödel C, Wittekind C, Fietkau R, et al. Preoperative versus postoperative chemoradiotherapy for rectal cancer. N Engl J Med. 2004;351:1731-1740. [Crossref]
4. Roh MS, Colangelo LH, O'Connell MJ, Yothers G, Deutsch M, Allegra CJ, et al. Preoperative multimodality therapy improves disease-free survival in patients with carcinoma of the rectum: NSABP R-03. J Clin Oncol. 2009;27:5124-5130. [Crossref]
5. Bahadoer RR, Dijkstra EA, van Etten B, Marijnen CAM, Putter H, Kranenbarg EM, et al. Short-course radiotherapy followed by chemotherapy before total mesorectal excision (TME) versus preoperative chemoradiotherapy, TME, and optional adjuvant chemotherapy in locally advanced rectal cancer (RAPIDO): a randomised, open-label, phase 3 trial. Lancet Oncol. 2021;22:29-42. [Crossref] Erratum in: Lancet Oncol. 2021;22:e42. [Crossref]
6. Conroy T, Bosset JF, Etienne PL, Rio E, François É, Mesgouez-Nebout N, et al. Neoadjuvant chemotherapy with FOLFIRINOX and preoperative chemoradiotherapy for patients with locally advanced rectal cancer (UNICANCER-PRODIGE 23): a multicentre, randomised, open-label, phase 3 trial. Lancet Oncol. 2021;22:702-715. [Crossref]
7. Mandard AM, Dalibard F, Mandard JC, Marnay J, Henry-Amar M, Petiot JF, et al. Pathologic assessment of tumor regression after preoperative chemoradiotherapy of esophageal carcinoma. Clinicopathologic correlations. Cancer. 1994;73:2680-2686. [Crossref]
8. Rödel C, Martus P, Papadoupolos T, Füzesi L, Klimpfinger M, Fietkau R, et al. Prognostic significance of tumor regression after preoperative chemoradiotherapy for rectal cancer. J Clin Oncol. 2005;23:8688-86896. [Crossref]
9. Fokas E, Liersch T, Fietkau R, Hohenberger W, Beissbarth T, Hess C, et al. Tumor regression grading after preoperative chemoradiotherapy for locally advanced rectal carcinoma revisited: updated results of the CAO/ARO/AIO-94 trial. J Clin Oncol. 2014;32:1554-1562. [Crossref]
10. Cupp MA, Cariolou M, Tzoulaki I, Aune D, Evangelou E, Berlanga-Taylor AJ. Neutrophil to lymphocyte ratio and cancer prognosis: an umbrella review of systematic reviews and meta-analyses of observational studies. BMC Med. 2020;18:360. [Crossref]
11. Malietzis G, Giacometti M, Kennedy RH, Athanasiou T, Aziz O, Jenkins JT. The emerging role of neutrophil to lymphocyte ratio in determining colorectal cancer treatment outcomes: a systematic review and meta-analysis. Ann Surg Oncol. 2014;21:3938-3946. [Crossref]
12. Jeon BH, Shin US, Moon SM, Choi JI, Kim MS, Kim KH, et al. Neutrophil to Lymphocyte ratio: a predictive marker for treatment outcomes in patients with rectal cancer who underwent neoadjuvant chemoradiation followed by surgery. Ann Coloproctol. 2019;35:100-106. [Crossref]
13. Carruthers R, Tho LM, Brown J, Kakumanu S, McCartney E, McDonald AC. Systemic inflammatory response is a predictor of outcome in patients undergoing preoperative chemoradiation for locally advanced rectal cancer. Colorectal Dis. 2012;14:e701-e707. [Crossref]
14. Kim IY, You SH, Kim YW. Neutrophil-lymphocyte ratio predicts pathologic tumor response and survival after preoperative chemoradiation for rectal cancer. BMC Surg. 2014;14:94. [Crossref]
15. Hanahan D, Weinberg RA. Hallmarks of cancer: the next generation. Cell. 2011;144:646-674. [Crossref]
16. Grivennikov SI, Greten FR, Karin M. Immunity, inflammation, and cancer. Cell. 2010;140:883-899. [Crossref]
17. Shen J, Zhu Y, Wu W, Zhang L, Ju H, Fan Y, et al. Prognostic role of neutrophil-to-lymphocyte ratio in locally advanced rectal cancer treated with neoadjuvant chemoradiotherapy. Med Sci Monit. 2017;23:315-324. [Crossref]

18. Krauthamer M, Rouvinov K, Ariad S, Man S, Walfish S, Pinsk I, et al. A study of inflammation-based predictors of tumor response to neoadjuvant chemoradiotherapy for locally advanced rectal cancer. Oncology. 2013;85:27-32. [Crossref]
19. Li H, Song J, Cao M, Wang G, Li L, Zhang B, et al. Preoperative neutrophil-to-lymphocyte ratio is a more valuable prognostic factor than platelet-to-lymphocyte ratio for nonmetastatic rectal cancer. Int Immunopharmacol. 2016;40:327-331. [Crossref]
20. Zou ZY, Liu HL, Ning N, Li SY, DU XH, Li R. Clinical significance of pre-operative neutrophil lymphocyte ratio and platelet lymphocyte ratio as prognostic factors for patients with colorectal cancer. Oncol Lett. 2016;11:2241-2248. [Crossref]