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Original Research Article

Systemic inflammatory markers neutrophil-lymphocyte, platelet-lymphocyte and monocyte-lymphocyte ratios as therapy response markers of epithelial ovarian cancer in Adam Malik Hospital Medan

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ABSTRACT

Background: Ovarian cancer has a complex pathological type, high recurrence rate, poor therapy response and prognosis. In recent years, examination of inflammatory markers of ovarian cancer therapy response has been developed. Systemic inflammatory response is closely related to cancer initiation, development and metastasis so that it can be used as a therapy response of ovarian cancer. This study aims to determine the systemic inflammatory markers NLR, PLR and MLR as a therapy response of epithelial ovarian cancer patients stage III after optimal debulking and complete adjuvant chemotherapy.
Methods: This study is an observational analytical study with a diagnostic test design on systemic blood inflammatory markers NLR, PLR, and MLR as marker of therapy response of epithelial ovarian cancer patients at Adam Malik Hospital Medan using retrospective data. This study involved a total of 135 patients with stage III epithelial ovarian cancer patients who had undergone optimal debulking and complete adjuvant chemotherapy from January 1 2018 to December 31 2022 with complete follow-up for 1 year.
Results: Based on the results of ROC curve analysis, the optimal cut off value for NLR was 2.4 (AUC: 73.2%, 95% CI: 64.1-82.4%, p<0.001) with a sensitivity of 69.9% and a specificity of 66.67%. The optimal cut off value for PLR was 173 (AUC: 82%, 95% CI: 74.4-89.5%, p<0.001) with a sensitivity of 77.4% and a specificity of 73.8%. The optimal cut off value for MLR was 0.5 (AUC: 66.2%, 95% CI: 54.9-77.6%, p<0.001) with a sensitivity of 71% and a specificity of 69%. There was a significant association between the NLR, PLR, and MLR values with the response to therapy in stage III epithelial ovarian cancer patients who had undergone debulking laparotomy and complete adjuvant chemotherapy (p<0.001). The result of multivariate analysis showed that the most dominant variable in predicting therapy response of epithelial ovarian cancer patients was PLR with the largest OR value of 7.823 (95% CI 7.268-187.947).
Conclusions: The optimal cut-off values of NLR, PLR, MLR statistically significant with therapy response of stage III epithelial ovarian cancer who had undergone optimal debulking and complete adjuvant chemotherapy. Increased levels of NLR, PLR, and MLR were more likely to be associated with a non-complete therapy response.

Keywords: Epithelial ovarian cancer, Blood inflammatory markers, Therapy response

INTRODUCTION

Epithelial ovarian cancer (EOC) remains one of the most lethal gynecologic malignancies worldwide and represents a major public health challenge because of its high mortality rate and frequent diagnosis at advanced stages.[1,2] According to GLOBOCAN 2022, ovarian cancer accounted for more than 324,000 new cases and over 206,000 deaths globally, making it one of the leading causes of cancer-related mortality among women.[1] In Indonesia, ovarian cancer remains one of the most common gynecological malignancies and contributes substantially to cancer-associated morbidity and mortality.[3] Despite advances in surgical techniques and systemic chemotherapy, long-term survival remains unsatisfactory, particularly among patients with advanced-stage epithelial ovarian cancer. Treatment resistance and disease recurrence continue to represent major clinical challenges despite these therapeutic advances.[4,5]

Approximately 70-80% of patients with epithelial ovarian cancer present with FIGO stage III or IV disease because early-stage ovarian cancer is frequently asymptomatic or associated with nonspecific clinical manifestations. Consequently, advanced-stage disease is characterized by extensive intraperitoneal dissemination, high recurrence rates, and poor overall survival. The current standard treatment consists of optimal cytoreductive surgery followed by platinum-based chemotherapy, which significantly improves patient outcomes.[3,4] Nevertheless, a considerable proportion of patients develop platinum resistance or experience incomplete therapeutic response despite receiving standard treatment.[2,3]

Growing evidence suggests that chronic systemic inflammation plays a pivotal role in ovarian carcinogenesis, tumor progression, angiogenesis, immune evasion, and chemotherapy resistance.[6-8] The interaction between tumor cells and inflammatory cells within the tumor microenvironment promotes tumor growth through the release of cytokines, chemokines, and angiogenic mediators.[7,8] Consequently, inflammatory biomarkers derived from routine peripheral blood tests have attracted increasing attention as potential prognostic and predictive biomarkers in epithelial ovarian cancer.[9,10]

Among these biomarkers, the neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and monocyte-to-lymphocyte ratio (MLR) have emerged as inexpensive, reproducible, and readily available biomarkers reflecting the balance between systemic inflammation and host immune response.[9,10] Elevated neutrophil counts promote tumor angiogenesis through the secretion of vascular endothelial growth factor (VEGF), interleukin-6 (IL-6), and transforming growth factor-β (TGF-β), whereas lymphocyte depletion reflects impaired antitumor immunity.[11,12] Platelets facilitate tumor growth, epithelial-mesenchymal transition, and metastatic dissemination by releasing platelet-derived growth factor (PDGF), VEGF, and TGF-β,13 while circulating monocytes differentiate into tumor-associated macrophages that suppress adaptive immunity and promote cancer progression.[14] These biological mechanisms provide a strong rationale for investigating inflammatory cell ratios as predictive biomarkers of chemotherapy response.[9,10]

Several recent studies have demonstrated that elevated NLR, PLR, and MLR are associated with advanced FIGO stage, suboptimal cytoreduction, platinum resistance, shorter progression-free survival, and reduced overall survival in epithelial ovarian cancer.[15-18] However, the reported cut-off values vary considerably across different populations owing to differences in ethnicity, tumor characteristics, treatment protocols, and study design.[9,16,18] Furthermore, evidence regarding the ability of these inflammatory markers to predict treatment response following primary complete cytoreductive surgery and platinum-based chemotherapy remains inconsistent.[19,20] Most published studies have primarily focused on survival outcomes rather than direct treatment response, and data from Southeast Asian populations, particularly Indonesia, remain limited.[21-23]

Given the simplicity, affordability, and widespread availability of complete blood count testing, inflammatory biomarkers have considerable potential for routine clinical application, particularly in low- and middle-income countries where access to advanced molecular biomarkers remains limited.[9,10] Early identification of patients at high risk of poor treatment response may facilitate individualized treatment planning, closer surveillance, and optimization of supportive care strategies.[9,10] Therefore, this study aimed to evaluate the predictive performance of NLR, PLR, and MLR for treatment response in patients with stage III epithelial ovarian cancer who underwent complete cytoreductive surgery followed by platinum-based adjuvant chemotherapy at H. Adam Malik General Hospital, Medan.

METHODS

Study design

This retrospective observational analytical study employed a diagnostic test design to evaluate the predictive performance of systemic inflammatory markers, namely the NLR, PLR, and MLR, for therapeutic response in patients with stage III epithelial ovarian cancer.

Study setting and period

The study was conducted at Adam Malik Hospital, Medan, Indonesia, a tertiary referral center for gynecologic oncology. Medical records of eligible patients treated between January 1, 2018, and December 31, 2022, were reviewed. Data collection was performed from May to August 2024.

Study participants

Patients were selected using a total sampling method.

Inclusion criteria

Patients with histopathologically confirmed stage III epithelial ovarian cancer; who underwent optimal primary debulking surgery with residual tumor <1 cm; who received six cycles of platinum-based adjuvant chemotherapy (carboplatin-paclitaxel); completed one-year follow-up after chemotherapy; and completed hematological data available before treatment were included.

Exclusion criteria

Patients with chronic inflammatory disease; autoimmune disease; hematological disorders; long-term corticosteroid therapy; and incomplete medical records were excluded.

Study procedures

Clinical and demographic characteristics were obtained from hospital medical records. Laboratory parameters, including neutrophil count, lymphocyte count, platelet count, and monocyte count, were collected from complete blood count examinations performed before initiation of chemotherapy. NLR was calculated by dividing the absolute neutrophil count by the absolute lymphocyte count, PLR by dividing platelet count by lymphocyte count, and MLR by dividing monocyte count by lymphocyte count.

Therapeutic response was evaluated one year after completion of chemotherapy according to the Response Evaluation Criteria in Solid Tumors (RECIST version 1.1). Patients were classified into complete therapeutic response and non-complete therapeutic response groups.

Ethical approval

The study protocol was approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sumatera Utara/H. Adam Malik General Hospital (approval number: No.24/KEPK/USU/2024). Patient confidentiality was maintained throughout the study.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 22. Continuous variables were presented as mean±standard deviation, whereas categorical variables were summarized as frequencies and percentages. Receiver operating characteristic (ROC) curve analysis was used to determine optimal cut-off values. Diagnostic accuracy was assessed using sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy. Associations between inflammatory markers and therapeutic response were analyzed using the Chi-square test. Variables with $p<0.25$ were entered into multivariate logistic regression analysis to identify independent predictors of therapeutic response. A p value <0.05 was considered statistically significant.

RESULTS

Demographic characteristics

A total of 281 stage III epithelial ovarian cancer patients were treated at Adam Malik Hospital in Medan from January 1, 2018, to December 31, 2022, and 179 of them have undergone optimal debulking and complete adjuvant chemotherapy. Out of that number, 135 patients met the inclusion criteria for the study with a follow-up period of 1 year. The majority of patients are aged 50-59 years (43%), with most being multigravida (38.5%) and nulliparous (32.6%), presenting with FIGO stage III C (47.4%) and serous histopathology type (46.7%). A total of 93 patients (68.9%) showed a non-complete response to therapy, while 42 patients (31.1%) achieved a complete response.

The predictive ability of the NLR for therapy response in epithelial ovarian cancer following complete debulking surgery and adjuvant chemotherapy

The ROC curve analysis shows that the AUC of NLR for predicting therapy response in patients with epithelial ovarian cancer who have undergone debulking laparotomy and complete adjuvant chemotherapy is 73.2% ($p<0.001$; 95% CI 64.1-82.4%), indicating that NLR is a good predictor of therapy response in these patients.

Based on the line graph in Figure 2, the cut-off value of NLR for predicting therapy response in patients with epithelial ovarian cancer who have undergone debulking laparotomy and complete adjuvant chemotherapy in this study is 2.4.

The predictive ability of the PLR for therapy response in epithelial ovarian cancer following complete debulking surgery and adjuvant chemotherapy

The ROC curve analysis shows that the AUC of PLR for predicting therapy response in patients with epithelial ovarian cancer who have undergone debulking laparotomy and complete adjuvant chemotherapy is 82.0% ($p<0.001$; 95% CI 74.4-89.5%), indicating that PLR is a very good predictor of therapy response in these patients.

Based on the line graph in Figure 4, the cutoff value of PLR for predicting therapy response in patients with epithelial ovarian cancer who have undergone debulking laparotomy and complete adjuvant chemotherapy in this study is 173.

Table 1: Demographic characteristics of stage iii epithelial ovarian cancer patients who have undergone complete debulking laparotomy and adjuvant chemotherapy (n=135).

Demographic characteristics	N (%)	Mean±SD
Age (in years)		
<40	10 (7.4)	
40-49	36 (26.7)	
50-59	58 (43)	
≥60	31 (23)	
Parity		
Nullipara	39 (28.9)	
Primigravida	19 (14.1)	
Secundigravida	25 (18.5)	
Multigravida	52 (38.5)	
FIGO		
III A	37 (27.4)	
III B	34 (25.2)	
III C	64 (47.4)	
Histopathology of EOC		
Serous	63 (46.7)	
Mucinous	26 (19.2)	
Endometroid	37 (27.4)	
Clear cell	9 (6.7)	
Response to therapy		
Non complete response	93 (68.9)	
Complete response	42 (31.1)	
Laboratory characteristics		
Neutrophil		5.01±5.84
Monocyte		0.4±0.42
Thrombocyte		309.82±952.55
Lymphocyte		20.67±11.8
Leukocyte		8.356±5.584
Absolute lymphocyte		1.49±0.74
NLR		5.38±6.37
PLR		320.21±953.79
MLR		0.57±0.35

Table 2: The value of the AUC, significance level, and cutoff value of NLR, PLR, and MLR in predicting therapy response in epithelial ovarian cancer that has undergone complete debulking laparotomy and adjuvant chemotherapy.

Variables	AUC (%)	95% CI	P	Cut off value
NLR	73.2	64,1% - 82,4%	<0.001	2.4
PLR	82.0	74,4% - 89,5%	<0.001	173
MLR	66.2	54,9% - 77,6%	<0.001	0.5

Table 3: The accuracy values of NLR, PLR, and MLR from research results in predicting therapy response epithelial ovarian cancer that has underwent d debulking laparotomy and complete adjuvant chemotherapy.

Parameters	Response to therapy		Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
	Not complete	Complete					
NLR							
≥2.4	65 (48.2)	14 (10.4)	69.9	66.67	82.3	50	68.89
<2.4	28 (20.7)	28 (20.7)					

Continued.

Parameters	Response to therapy		Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
	Not complete	Complete					
PLR							
≥173	72 (53.3)	11 (8.1)	77.4	73.8	86.7	59.6	76.3
<173	21 (15.6)	31 (23.0)					
MLR							
≥0.5	61 (45.2)	13 (9.6)	71.0	69	82.4	47.5	66.67
<0.5	32 (23.7)	29 (21.5)					

Table 4: Association of NLR, PLR, and MLR with treatment response and multivariate analysis of factors affecting treatment response in patients with epithelial ovarian cancer following complete debulking surgery and adjuvant chemotherapy.

Variables	Response to therapy		P*	OR	95% CI for OR	
	Not complete	Complete			Lower	Upper
NLR						
≥2.4	65 (48.1)	14 (10.4)	0.004	2.229	1.899	32.237
<2.4	28 (20.7)	28 (20.7)				
PLR						
≥173	72 (53.3)	11 (8.1)	0.001	7.823	7.268	187.947
<173	21 (15.6)	31 (23.0)				
MLR						
≥0.5	61 (45.2)	13 (9.6)	0.001	3.437	5.976	179.263
<0.5	32 (23.7)	29 (21.5)				

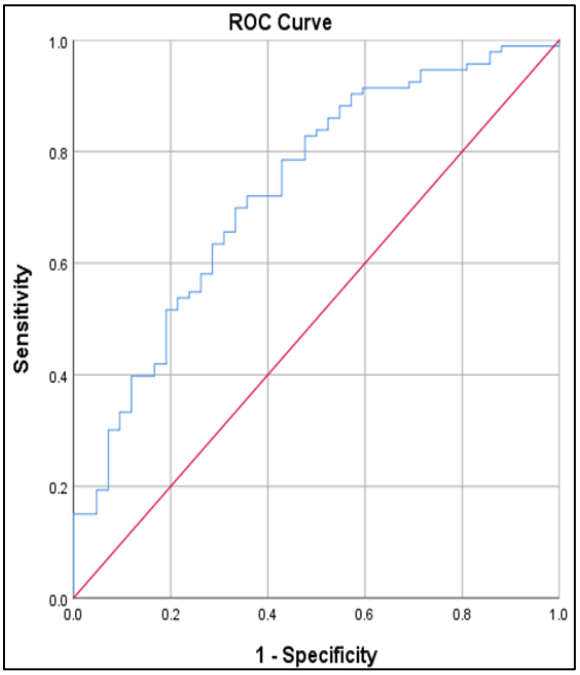

Figure 1: ROC Curve of NLR as a predictor of therapy response in epithelial ovarian cancer after debulking laparotomy and complete adjuvant chemotherapy.

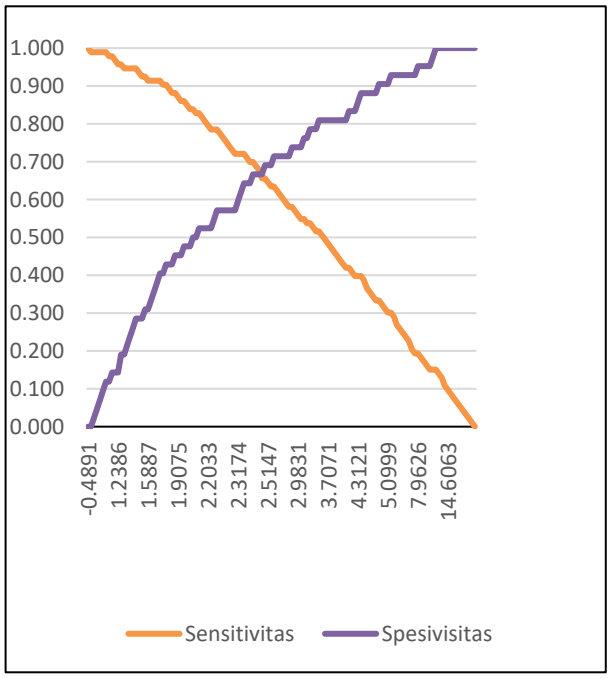

Figure 2: Line Graph of NLR as a predictor of therapy response in epithelial ovarian cancer after debulking laparotomy and complete adjuvant chemotherapy.

The predictive ability of the MLR for therapy response in epithelial ovarian cancer following complete debulking surgery and adjuvant chemotherapy

The ROC curve analysis shows that the AUC of MLR for predicting therapy response in patients with epithelial ovarian cancer who have undergone debulking laparotomy and complete adjuvant chemotherapy is 66.2% ($p<0.001$; 95% CI 54.9-77.6%), indicating that MLR is a good predictor of therapy response in these patients.

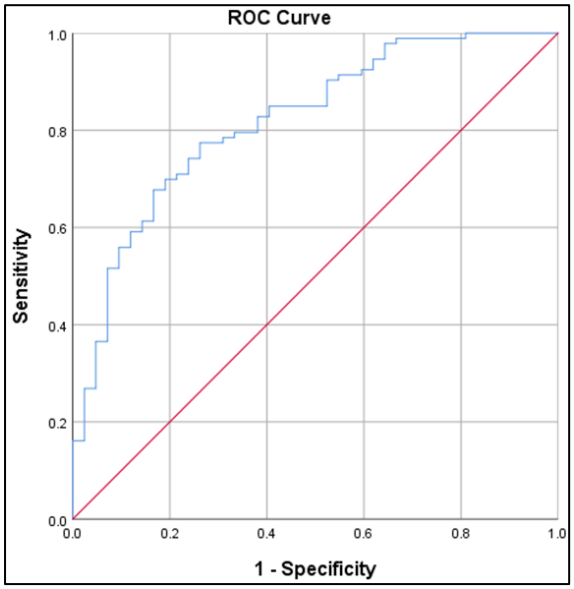

Figure 3: ROC Curve of PLR as a predictor of therapy response in epithelial ovarian cancer after complete debulking laparotomy and adjuvant chemotherapy.

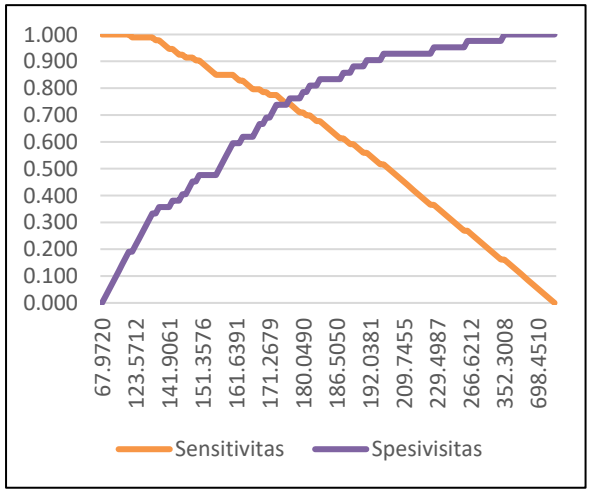

Figure 4: Line graph of PLR as a predictor of therapy response in epithelial ovarian cancer after complete debulking laparotomy and adjuvant chemotherapy.

Based on the line graph in Figure 6, the cutoff value of MLR for predicting the therapeutic response in patients with epithelial ovarian cancer who have undergone debulking laparotomy and complete adjuvant chemotherapy in this study is 0.5.

The AUC value, significance level, and cutoff value of NLR, PLR, and MLR in predicting therapy response in epithelial ovarian cancer that has undergone complete debulking laparotomy and adjuvant chemotherapy.

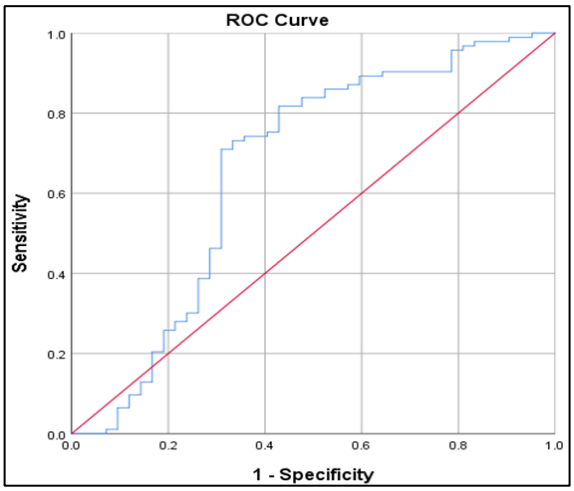

Figure 5: ROC curve of MLR as a predictor of therapy response in epithelial ovarian cancer after complete debulking laparotomy and adjuvant chemotherapy.

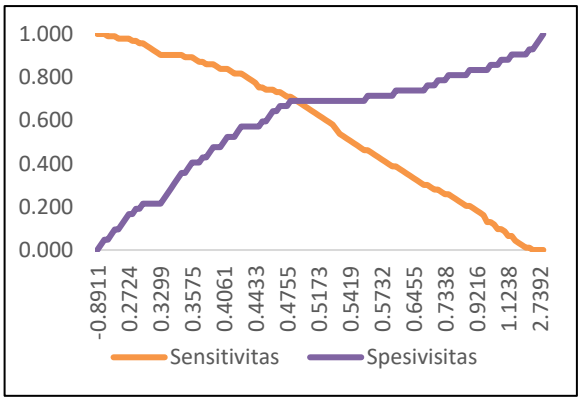

Figure 6: Line graph of MLR as a predictor of therapy response in epithelial ovarian cancer after debulking laparotomy and complete adjuvant chemotherapy.

The recap of the analysis shows that the AUC values for NLR, PLR, and MLR in predicting therapy response in patients with epithelial ovarian cancer are 73.2%, 82.0%, and 66.2% with cut-off values of 2.4, 173, and 0.5, respectively. These results indicate that the three inflammatory markers can be used to predict therapy response, with PLR having the highest predictive capability.

Based on the AUC values, PLR has the best predictive ability for predicting therapy response in patients with

epithelial ovarian cancer who have undergone debulking laparotomy and complete adjuvant chemotherapy, followed by MLR and NLR.

Table 3 shows that PLR has the highest accuracy rate of 76.3%, followed by MLR at 69%, and NLR at 68.7%, reflecting the effectiveness of each marker in predicting therapy response in these patients.

Association of NLR, PLR, and MLR with therapy response and multivariate analysis of factors affecting therapy response in patients with epithelial ovarian cancer following complete debulking surgery and adjuvant chemotherapy

Among the 79 patients with an NLR ≥2.4, 65 (82.3%) had an incomplete treatment response, whereas only 28 of the 56 patients (50%) with an NLR <2.4 had an incomplete treatment response. The Chi-square test demonstrated a significant association between NLR and treatment response in patients with stage III epithelial ovarian cancer following complete debulking surgery and adjuvant chemotherapy (p<0.001). Similarly, among the 83 patients with a PLR ≥173, 72 (86.7%) had an incomplete treatment response, compared with 21 of the 52 patients (40.4%) with a PLR <173. The Chi-square test also demonstrated a significant association between PLR and treatment response in these patients (p<0.001).

Likewise, among the 74 patients with an MLR ≥0.5, 61 (82.4%) had an incomplete treatment response, whereas only 32 of the 61 patients (52.5%) with an MLR < 0.5 had an incomplete treatment response. The Chi-square test also demonstrated a significant association between MLR and treatment response in patients with stage III epithelial ovarian cancer following complete debulking surgery and adjuvant chemotherapy (p<0.001).

The multivariate analysis in this study aims to identify the independent variables that influence the dependent variable and to determine the most dominant independent variables in predicting therapy response in patients with epithelial ovarian cancer after debulking laparotomy and adjuvant chemotherapy at Adam Malik Hospital. Multiple logistic regression is used because the dependent variable is categorical. The independent variables included in the analysis are those with a p value <0.25 from the bivariate analysis, namely NLR, MLR, and PLR.

Multivariate analysis shows that all variables influence the therapy response in ovarian cancer patients. The PLR variable is the most dominant with the highest OR value of 7.823 (95% CI 7.268-187.947). Patients with PLR ≥173 have a 7 times greater risk of experiencing an incomplete therapeutic response compared to patients with PLR <173. The MLR variable ranks second with an OR value of 3.437 (95% CI 5.976-179.263). Patients with MLR ≥0.5 are three times more likely to experience an incomplete therapy response compared to patients with MLR <0.5. The NLR variable ranks third, with an OR value of 2.229 (95% CI 1.899-32.237). Patients with NLR ≥2.4 have a twofold increased risk of experiencing an incomplete therapy response compared to patients with NLR <2.4.

DISCUSSION

The present study demonstrated that pretreatment systemic inflammatory markers, including NLR, PLR, and MLR, were significantly associated with treatment response in patients with stage III epithelial ovarian cancer who underwent optimal cytoreductive surgery followed by platinum-based chemotherapy. Among these biomarkers, PLR showed the highest predictive performance and emerged as the strongest independent predictor of treatment response. Our findings are consistent with accumulating evidence indicating that systemic inflammation reflects tumor aggressiveness and influences treatment response in epithelial ovarian cancer.[6,9,10]

Persistent inflammation contributes to multiple stages of tumor development, including malignant transformation, angiogenesis, immune evasion, invasion, and metastasis.[7,8] Within the ovarian cancer microenvironment, inflammatory cytokines such as interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α), transforming growth factor-β (TGF-β), and vascular endothelial growth factor (VEGF) promote tumor growth while suppressing antitumor immune responses.[6,10] Consequently, peripheral blood inflammatory indices serve as readily available surrogate markers of the interaction between tumor biology and host immune response.[9,10] The present findings are biologically plausible because elevated inflammatory cell ratios likely reflect a tumor-promoting immune microenvironment characterized by enhanced angiogenesis, chronic inflammation, and impaired antitumor immunity. This may explain why patients with higher pretreatment NLR, PLR, and MLR were more likely to exhibit an incomplete treatment response.

Among the inflammatory biomarkers evaluated in this study, elevated pretreatment NLR was significantly associated with an incomplete treatment response. This finding is biologically plausible because neutrophils promote tumor progression through the release of vascular endothelial growth factor (VEGF), matrix metalloproteinases, reactive oxygen species, and neutrophil extracellular traps (NETs), which enhance angiogenesis, extracellular matrix remodeling, and metastatic dissemination. In contrast, lymphocytes are key mediators of antitumor immunity through cytotoxic T-cell responses and immune surveillance. Therefore, an elevated NLR likely reflects an imbalance between protumor inflammation and host immune defense, which may contribute to a less favorable response to platinum-based chemotherapy. Our findings are consistent with previous studies demonstrating that elevated pretreatment NLR is associated with platinum resistance, shorter progression-free survival, and reduced overall survival in patients with epithelial ovarian cancer.[6,11,15,21,23]

However, the optimal cut-off values identified in the present study differed from those reported in previous studies, which may reflect differences in patient ethnicity, disease stage, treatment protocols, and statistical methods used to determine the optimal thresholds. Similar variability in inflammatory marker cut-off values has been consistently reported across different populations, highlighting the importance of external validation before these biomarkers can be routinely implemented in clinical practice.[6,16,18,21,24]

Platelets are increasingly recognized as active participants in cancer progression rather than passive mediators of hemostasis. Activated platelets protect circulating tumor cells from immune-mediated destruction, facilitate their adhesion to the vascular endothelium, and release multiple growth factors, including PDGF, TGF-β, and VEGF, thereby promoting angiogenesis, epithelial-mesenchymal transition, and metastatic dissemination.[13] In addition, platelet-derived cytokines contribute to the establishment of an immunosuppressive tumor microenvironment that favors tumor progression.[9] Consequently, an elevated PLR likely reflects an enhanced protumor inflammatory state and has been associated with more aggressive disease behavior.[9,13]

In the present study, pretreatment PLR demonstrated the highest predictive performance among the evaluated inflammatory biomarkers and emerged as the strongest independent predictor of treatment response. This finding is consistent with previous studies by Kovács et al, Tuntinarawat et al and Zahav et al which demonstrated that elevated PLR was independently associated with poor chemotherapy response, platinum resistance, and unfavorable survival outcomes in patients with advanced epithelial ovarian cancer.[8,16,19]

Monocytes are another important component of the systemic inflammatory response. Following infiltration into the tumor microenvironment, circulating monocytes differentiate into tumor-associated macrophages (TAMs), particularly the M2 phenotype, which promotes angiogenesis, extracellular matrix remodeling, immune suppression, and tumor progression.[14] Increased monocyte counts accompanied by lymphopenia result in an elevated MLR, reflecting an immunosuppressive tumor microenvironment. Consequently, elevated MLR has been associated with unfavorable oncologic outcomes in epithelial ovarian cancer.[20,24,25]

Although MLR demonstrated lower predictive performance than NLR and PLR in the present study, elevated pretreatment MLR remained significantly associated with an incomplete treatment response. Our findings are consistent with previous studies demonstrating that elevated MLR is associated with poor prognosis and adverse clinical outcomes in epithelial ovarian cancer, although its predictive performance is generally inferior to that of NLR and PLR.[16,24,25]

One of the principal findings of the present study was the superior predictive performance of PLR compared with both NLR and MLR. Several biological mechanisms may explain this observation. Platelets directly interact with ovarian cancer cells through the release of proangiogenic mediators, including VEGF, PDGF, and TGF-β, thereby enhancing tumor proliferation, promoting epithelial-mesenchymal transition, and protecting circulating tumor cells from natural killer cell-mediated cytotoxicity.[9,13] These mechanisms are particularly relevant in advanced-stage epithelial ovarian cancer, where extensive peritoneal dissemination depends largely on angiogenesis and immune evasion.[8,13] Consequently, PLR may better capture the biological processes underlying tumor aggressiveness and chemotherapy resistance than leukocyte-based inflammatory indices alone, which may explain its superior predictive performance observed in the present study.[8,13,18]

The present findings have several important clinical implications. NLR, PLR, and MLR are inexpensive, readily obtainable, and routinely available from routine complete blood count testing, making them attractive biomarkers for clinical application, particularly in resource-limited settings.[9,10] Identification of patients with elevated pretreatment inflammatory indices may assist clinicians in identifying individuals who may benefit from closer follow-up, individualized risk assessment, and more intensive surveillance.[22] Furthermore, these inflammatory biomarkers may complement established clinicopathological prognostic factors, such as FIGO stage, residual tumor status, and serum CA-125 levels, thereby improving risk stratification in patients with epithelial ovarian cancer.[6,8] This approach may be especially valuable in low- and middle-income countries, where access to advanced molecular biomarkers remains limited.[6,8]

This study has several important strengths. A major strength is the relatively homogeneous study population, as all included patients underwent optimal cytoreductive surgery followed by standardized platinum-based adjuvant chemotherapy at a single tertiary referral center, thereby minimizing treatment-related heterogeneity. Furthermore, treatment response was assessed using standardized RECIST version 1.1 criteria, ensuring objective evaluation of therapeutic outcomes.

Nevertheless, several limitations should be acknowledged. First, the retrospective study design may have been susceptible to selection bias and residual confounding. Second, this was a single-center study with a relatively modest sample size, which may limit the generalizability of the findings. Third, inflammatory biomarkers were measured only before treatment, precluding evaluation of dynamic changes during chemotherapy. Future prospective multicenter studies involving larger and more diverse patient populations, serial assessment of inflammatory biomarkers, and integration with molecular

biomarkers are warranted to validate these findings and establish clinically applicable cut-off values.

CONCLUSION

Pretreatment NLR, PLR, and MLR were significantly associated with treatment response in patients with stage III epithelial ovarian cancer who underwent optimal cytoreductive surgery followed by platinum-based adjuvant chemotherapy. Among these inflammatory biomarkers, PLR demonstrated the highest predictive performance and emerged as the strongest independent predictor of treatment response. Given their low cost, wide availability, and ease of measurement from routine complete blood count testing, these biomarkers may provide useful adjunctive tools for risk stratification and treatment planning in appropriately selected patients. Nevertheless, prospective multicenter studies with larger populations are needed to validate these findings and establish standardized cut-off values before routine clinical implementation.

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