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ORIGINAL RESEARCH

Prognostic Value of C-Reactive Protein-to-Lymphocyte Ratio in Combined Immunotherapy and Chemotherapy for Small Cell Lung Cancer

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Purpose: Inflammatory indexes are emerging as sensible prognostic factors for small cell lung cancer (SCLC). However, the prognostic value of dynamic C-reactive protein-to-lymphocyte ratio (CLR) in SCLC patients treated with chemoimmunotherapy remains unclear.

Patients and Methods: This retrospective study investigated 88 SCLC patients who underwent chemoimmunotherapy between January 1st, 2020 and December 12th 2022. We examined the association between CLR and prognostic outcomes after chemoimmunotherapy. The associations between objective response rate (ORR), progression-free survival (PFS) with changes in blood indicators were also analyzed.

Results: Patients with decreased CLR had significantly higher ORR, with odds ratios of 3.91 (P<0.05) and 3.19 (P<0.05) in univariate and multivariate logistic regression analyses, respectively. Kaplan-Meier analysis showed that decreased CLR was associated with prolonged PFS (P=0.02). Additionally, a CLR higher than 2.47 after treatment was associated with poor survival in both univariate and multivariate analyses.

Conclusion: Dynamic CLR can serve as a potential biomarker for predicting the prognosis of SCLC patients treated with chemoimmunotherapy. Reduction of CLR after chemoimmunotherapy is associated with a significantly higher ORR and improved PFS.

Keywords: small cell lung cancer, chemoimmunotherapy, C-reactive protein-to-lymphocyte ratio

Introduction

Small cell lung cancer (SCLC) is a highly aggressive neuroendocrine tumor characterized by rapid proliferation and early metastasis.[1] It accounts for approximately 15% to 20% of all lung cancers.[2] Recent advancements in the treatment of SCLC, particularly the development of programmed cell death protein 1 (PD-1) and programmed death-ligand 1 (PD-L1) checkpoint inhibitors, have significantly enriched therapeutic strategies.[3–6] The identification of precise and reliable biomarkers for predicting chemoimmunotherapy response is critical to optimize treatment strategies. Such biomarkers not only improve the accuracy and efficacy of immunotherapy but also advance the development of personalized medicine.

Cancer-related inflammation contributes to immunosuppression within tumors, thereby promoting cancer development and progression.[7] Multiple clinical studies have demonstrated that the systemic inflammatory response is a predictor of tumor recurrence and survival in hepatocellular, colorectal, prostate and cervical carcinomas.[8–12]

Previous studies have identified systematic inflammatory markers like the neutrophil-to- lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), and modified Glasgow prognostic score are associated with undesirable clinical outcomes in patients with SCLC.[13–17] Nonetheless, it remains unclear which combination of inflammatory factors is best for predicting survival in SCLC patients being treated with chemoimmunotherapy.

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Recently, the C-reactive protein-to-lymphocyte ratio (CLR) has emerged as a notable composite inflammatory index, combining C-reactive protein levels with circulating lymphocyte counts. CLR has shown promise as a prognostic factor in gastric cancer, colorectal liver metastases, and pancreatic cancer.[18–20] However, to our knowledge, no studies have evaluated the association between CLR and the prognosis of SCLC patients undergoing chemoimmunotherapy. While pretreatment CLR offers prognostic baseline data, serial monitoring captures immunotherapy-induced immune dynamics. This approach offers superior predictive power for treatment response and clinical decision-making.

In this study, we aim to investigate the prognostic value of dynamic change in CLR for predicting clinical outcomes in SCLC patients after chemoimmunotherapy.

Materials and Methods

Study Design

Medical records of patients diagnosed with small cell lung cancer (SCLC) and treated with chemotherapy plus immunotherapy at Beijing Chest Hospital were included in this retrospective study. Inclusion criteria were: (1) histopathological confirmation of SCLC, and (2) receiving PD-L1/PD-1 inhibitor treatment combined with chemotherapy for the first time. Exclusion criteria were as follows: (1) Patients who received anti-infective therapy (including antibiotics, antifungals, or antivirals) within one week before or after blood sampling. (2) Patients who underwent surgery following combination treatment. (3) Patients with missing or unavailable data.

Treatment and Data Collection

Patients received the following therapy: 1200 mg atezolizumab, 1500 mg durvalumab, 200 mg sintilimab, 200 mg camrelizumab, or 200 mg tislelizumab intravenously every 3 weeks. Combination chemotherapy included platinum-etoposide, nab-paclitaxel, and irinotecan. Treatment continued with maintenance of anti-PD-L1/PD-1 inhibitors until tumor progression, development of unacceptable drug toxicity, or death. Clinical and laboratory data were collected, including age, sex, Eastern Cooperative Oncology Group performance status (ECOG performance status), smoking history, treatment details, and therapeutic response. Blood results and the incidence of immune-related adverse events (irAEs) were also documented. The medical data of patients was handled with the utmost confidentiality, without any intervention.

This study was conducted in accordance with the ethical standards set forth in the Declaration of Helsinki and received approval from the Ethics Committee of Beijing Chest Hospital (Approval No. LW-2025-012). Informed consent for treatment was required; however, written informed consent for enrolment into this study was not required, as this was a retrospective study.

Peripheral blood samples were collected before initiation of the combined therapy (time point 1, baseline) and before the third cycle of combined therapy (time point 2, post-treatment). If disease progression occurred before the expected time point 2, a peripheral blood sample was collected during the computed tomography (CT) assessment of disease progression. Complete blood counts, including C-reactive protein (CRP), absolute neutrophil count (ANC), absolute lymphocyte count (ALC), absolute monocyte count (AMC), and platelet count, were recorded at baseline (time point 1) and at the third cycle of combined therapy (time point 2).

CLR was defined as the ratio of CRP to ALC, NLR as the ratio of ANC to ALC, MLR as the ratio of AMC to ALC, and PLR as the ratio of platelet count to ALC. Inflammatory biomarkers were calculated at time points 1 and 2. Patients were categorized into two groups based on changes in inflammatory biomarkers: an increase was defined if the post-treatment biomarker was higher than the baseline, and a decrease if the post-treatment biomarker was lower than the baseline.

Statistical Analysis

Categorical variables are summarized as frequencies and percentages. The objective response rate (ORR) was defined as the percentage of patients who achieved a complete response (CR) or partial response (PR) among all treated patients. Progression-free survival (PFS) was defined as the duration from the initiation of combined therapy to the date of first

documented disease progression or death. The $\chi 2$ test was used to examine differences in baseline characteristics between the decreased and increased groups.

Kaplan-Meier survival curves were plotted, and the Log rank test was applied to examine survival differences between the two groups. Factors associated with ORR were tested with logistic regression in univariate and multivariate analyses. The Cox proportional hazards model was used to calculate hazard ratios (HRs) and evaluate factors independently associated with PFS. SPSS 26.0 software (SPSS Inc., Chicago, IL, USA) and GraphPad Prism software (Prism 10) was used for the statistical analyses. A two-sided p-value of <0.05 was considered statistically significant.

Results

Patient Characteristics

This study enrolled 117 patients between January 1, 2020 and December 12, 2022. After the exclusion of 29 patients, 88 patients were included in the current analysis. The baseline clinicopathologic characteristics of all patients are summarized in Table 1. The median age was 65 years, with 49 patients (55.7%) above 65 years old. The male proportion was

Table 1 The Baseline Clinicopathologic Characteristics of 88 Patients

Characteristics	*N* (%)
Age (years)	
Median	65
Range	46-80
<65	39(44.3)
≥65	49(55.7)
Sex	
Female	18(20.5)
Male	70(79.5)
Smoking history	
Never	22(25)
Current/former	66(75)
Stage	
Limited disease	14(15.9)
Extended disease	74(84.1)
ECOG PS	
0-1 score	54(61.4)
≥2 score	34(38.6)
Agent	
PD-1 antibody	10(11.4)
PD-L1 antibody	78(88.6)
Line of treatment	
≤2	78(88.6)
>2	10(11.4)
Brain metastases	
Yes	23(26.1)
No	65(73.9)

(*Continued*)

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Table 1 (Continued).

Characteristics	*N* (%)
Liver metastases	
Yes	20(22.7)
No	68(77.3)
Bone metastases	
Yes	20(22.7)
No	68(77.3)
Other metastases	
Yes	25(28.4)
No	63(71.6)
irAEs	
Yes	15(17)
No	73(83)

Abbreviation: ECOG PS, Eastern Cooperative Oncology Group performance status; PD-1, programmed cell death protein 1; PD-L1, programmed death-ligand 1; irAEs, immune-related adverse events.

79.5%. Among all patients, 66 (75%) had a smoking history, 74 (84.1%) were initially diagnosed with extensive-stage disease, and 54 (61.4%) had ECOG performance status of 0 or 1. Additionally, 65 patients (73.9%) had brain metastases, 68 patients (77.3%) had liver metastases, 68 patients (77.3%) had bone metastases, and 63 (73.3%) had other distant metastases. The majority of patients (78/88, 88.6%) received first- or second-line treatment.

Before the third cycle of chemoimmunotherapy, 53 patients (60.2%) displayed decreased CLR, while 35 patients (39.8%) displayed increased CLR. These patients were subsequently assigned to the respective decreased and increased CLR groups. Similarly, the 88 patients were divided into decreased and increased MLR groups, decreased and increased NLR groups, and decreased and increased PLR groups. The differences between blood parameters among each clinicopathologic characteristic were shown in Table 2.

Table 2 Clinicopathological Characteristics Stratified by Decreased or Increased Groups of Each Blood Parameter

Characteristics	CLR		*P*	NLR		*P*	MLR		*P*	PLR		*P*
	Decrease / Increase			Decrease / Increase			Decrease / Increase			Decrease / Increase		
	N=53	N=35		N=33	N=55		N=27	N=61		N=46	N=42	
Age (years), n (%)												
<65	20 (37.7) / 19 (54.3)		0.126	13 (39.4) / 26 (47.3)		0.471	10 (37.0) / 29 (47.5)		0.360	26 (56.5) / 13 (31.0)		0.016*
≥65	33 (62.3) / 16 (45.7)			20 (60.6) / 29 (52.7)			17 (63.0) / 32 (52.5)			20 (43.5) / 29 (69.0)		
Sex, n (%)												
Male	40 (75.5) / 30 (85.7)		0.244	26 (78.8) / 44 (80.0)		0.891	21 (77.8) / 49 (80.3)		0.784	36 (78.3) / 34 (81.0)		0.755
Female	13 (24.5) / 5 (14.3)			7 (21.2) / 11 (20.0)			6 (22.2) / 12 (19.7)			10 (21.7) / 8 (19.0)		
Smoking history, n (%)												
Never	15 (28.3) / 7 (20.0)		0.379	10 (30.3) / 12 (21.8)		0.374	6 (22.2) / 16 (26.2)		0.689	12 (26.1) / 10 (23.8)		0.805
Current/former	38 (71.7) / 28 (80.0)			23 (69.7) / 43 (78.2)			21 (77.8) / 45 (73.8)			34 (73.9) / 32 (76.2)		
Stage, n (%)												
Limited disease	9 (17.0) / 5 (14.3)		0.735	6 (18.2) / 8 (14.5)		0.652	4 (14.8) / 10 (16.4)		1	9 (19.6) / 5 (11.9)		0.326
Extended disease	44 (83.0) / 30 (85.7)			27 (81.8) / 47 (85.5)			23 (85.2) / 51 (83.6)			37 (80.4) / 37 (88.1)		

(*Continued*)

Table 2 (Continued).

Characteristics	CLR		P	NLR		P	MLR		P	PLR		P
	Decrease / Increase			Decrease / Increase			Decrease / Increase			Decrease / Increase		
	N=53	N=35		N=33	N=55		N=27	N=61		N=46	N=42	
ECOG PS, n (%)												
0-1 score	35 (66.0) / 19 (54.3)		0.268	18 (54.5) / 36 (65.5)		0.309	14 (51.9) / 40 (65.6)		0.223	28 (60.9) / 26 (61.9)		0.921
≥2 score	18 (34.0) / 16 (45.7)			15 (45.5) / 19 (34.5)			13 (48.1) / 21 (34.4)			18 (39.1) / 16 (38.1)		
Agent, n (%)												
PD-1 antibody	5 (9.4) / 5 (14.3)		0.483	3 (9.1) / 7 (12.7)		0.737	3 (11.1) / 7 (11.5)		1	2 (4.3) / 8 (19.0)		0.043*
PD-L1 antibody	48 (90.6) / 30 (85.7)			30 (90.9) / 48 (87.3)			24 (88.9) / 54 (88.5)			44 (95.7) / 34 (81.0)		
Line of treatment, n (%)												
≤2	49 (92.5) / 29 (82.9)		0.187	32 (97.0) / 46 (83.6)		0.083	27 (100.0) / 51 (83.6)		0.028†	44 (95.7) / 34 (81.0)		0.043†
>2	4 (7.5) / 6 (17.1)			1 (3.0) / 9 (16.4)			0 (0.0) / 10 (16.4)			2 (4.3) / 8 (19.0)		
Brain metastases												
Yes	12 (22.6) / 11 (31.4)		0.359	10 (30.3) / 13 (23.6)		0.491	4 (14.8) / 19 (31.1)		0.108	11 (23.9) / 12 (28.6)		0.619
No	41 (77.4) / 24 (68.6)			23 (69.7) / 42 (76.4)			23 (85.2) / 42 (68.9)			35 (76.1) / 30 (71.4)		
Liver metastases												
Yes	11 (20.8) / 9 (25.7)		0.587	5 (15.2) / 15 (27.3)		0.189	5 (18.5) / 15 (24.6)		0.531	5 (10.9) / 15 (35.7)		0.005*
No	42 (79.2) / 26 (74.3)			28 (84.8) / 40 (72.7)			22 (81.5) / 46 (75.4)			41 (89.1) / 27 (64.3)		
Bone metastases												
Yes	11 (20.8) / 9 (25.7)		0.587	9 (27.3) / 11 (20.0)		0.431	6 (22.2) / 14 (23.0)		0.94	12 (26.1) / 8 (19.0)		0.431
No	42 (79.2) / 26 (74.3)			24 (72.7) / 44 (80.0)			21 (77.8) / 47 (77.0)			34 (73.9) / 34 (81.0)		
Other metastases												
Yes	17 (32.1) / 8 (22.9)		0.348	9 (27.3) / 16 (29.1)		0.855	5 (18.5) / 20 (32.8)		0.171	13 (28.3) / 12 (28.6)		0.974
No	36 (67.9) / 27 (77.1)			24 (72.7) / 39 (70.9)			22 (81.5) / 41 (67.2)			33 (71.7) / 30 (71.4)		
irAEs												
Yes	8 (15.1) / 7 (20.0)		0.549	7 (21.2) / 8 (14.5)		0.421	7 (25.9) / 8 (13.1)		0.217	10 (21.7) / 5 (11.9)		0.220
No	45 (84.9) / 28 (80.0)			26 (78.8) / 47 (85.5)			20 (74.1) / 53 (86.9)			36 (78.3) / 37 (88.1)		

Notes: *$p < 0.05$ are considered significant; †$p < 0.05$ and fisher's exact test was employed (expected count <5 in one cell).
Abbreviations: CLR, c-reactive protein-to-lymphocyte ratio; NLR, neutrophil-to-lymphocyte ratio; MLR, monocyte-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio.

Objective Response Rate

The ORRs for patients in the decreased and increased CLR groups were 69.8% and 37.1%, respectively (P=0.002). The ORRs for the decreased and increased NLR groups were 60.6% and 54.5%, respectively (P>0.05). The ORRs for the decreased and increased MLR groups were 70.4% and 50.8% (P>0.05), and for the decreased and increased PLR groups were 63.0% and 50.0%, respectively (P>0.05) (Figure 1).

Univariate and multivariate analyses for ORR revealed no significant associations between age, ECOG performance status, immune-related adverse events (irAEs), MLR, NLR, and PLR with ORR (all P>0.05). However, decreased CLR was significantly associated with elevated ORR in both univariate (OR=3.91, 95% CI: 1.588–9.647; P=0.003) and multivariate (OR=3.19, 95% CI: 1.165–8.702; P=0.024) analyses (Figure 2).

Progression-Free Survival

The median PFS was 6.7 months. Kaplan-Meier plots (Figure 3) revealed that a decrease in CLR at the third cycle of combined therapy was associated with prolonged PFS (P=0.02). However, no significant correlation was found between decreased MLR, decreased NLR, and decreased PLR with prolonged survival.

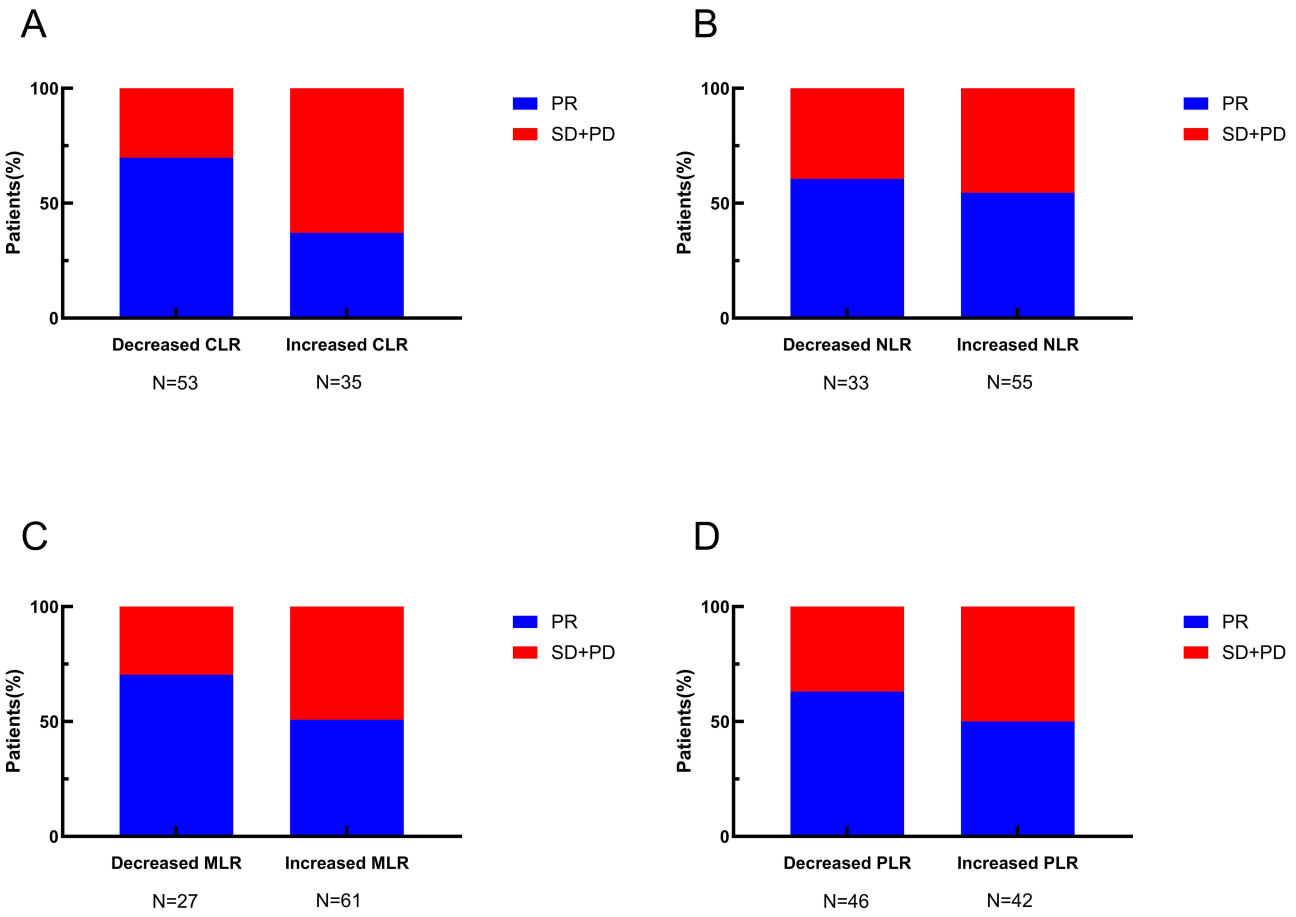

Figure 1 Treatment response distribution by changes in (**A**) the decreased and increased CLR groups (69.8% vs 37.1%, P=0.002); (**B**) the decreased and increased NLR groups (60.6% vs 54.5%, P>0.05); (**C**) the decreased and increased MLR groups (70.4% vs 50.8%, P>0.05); (**D**) the decreased and increased PLR groups (63.0% vs 50.0%, P>0.05).

Abbreviations: CLR, c-reactive protein-to-lymphocyte ratio; NLR, neutrophil-to-lymphocyte ratio; MLR, monocyte-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; PD, progressive disease; SD, stable disease; PR, partial response.

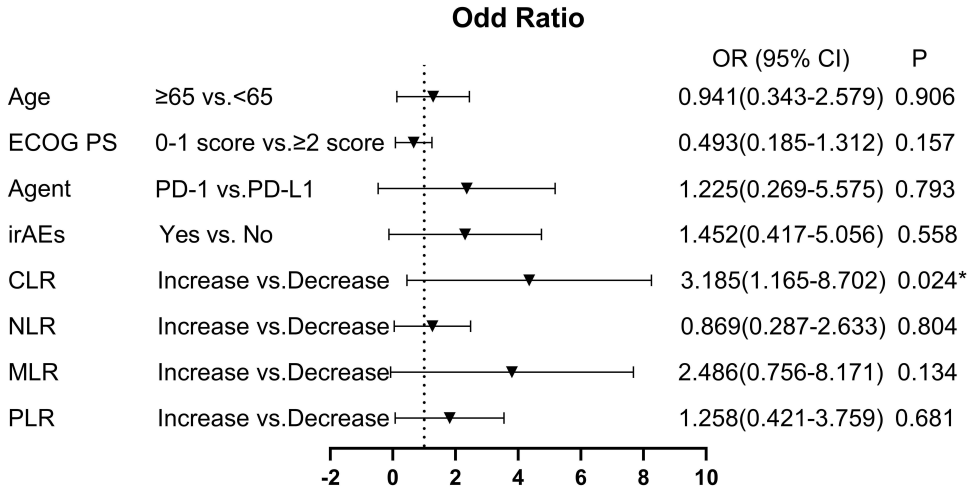

Figure 2 Multivariate analysis of ORR. *P<0.05 indicates statistical significance.

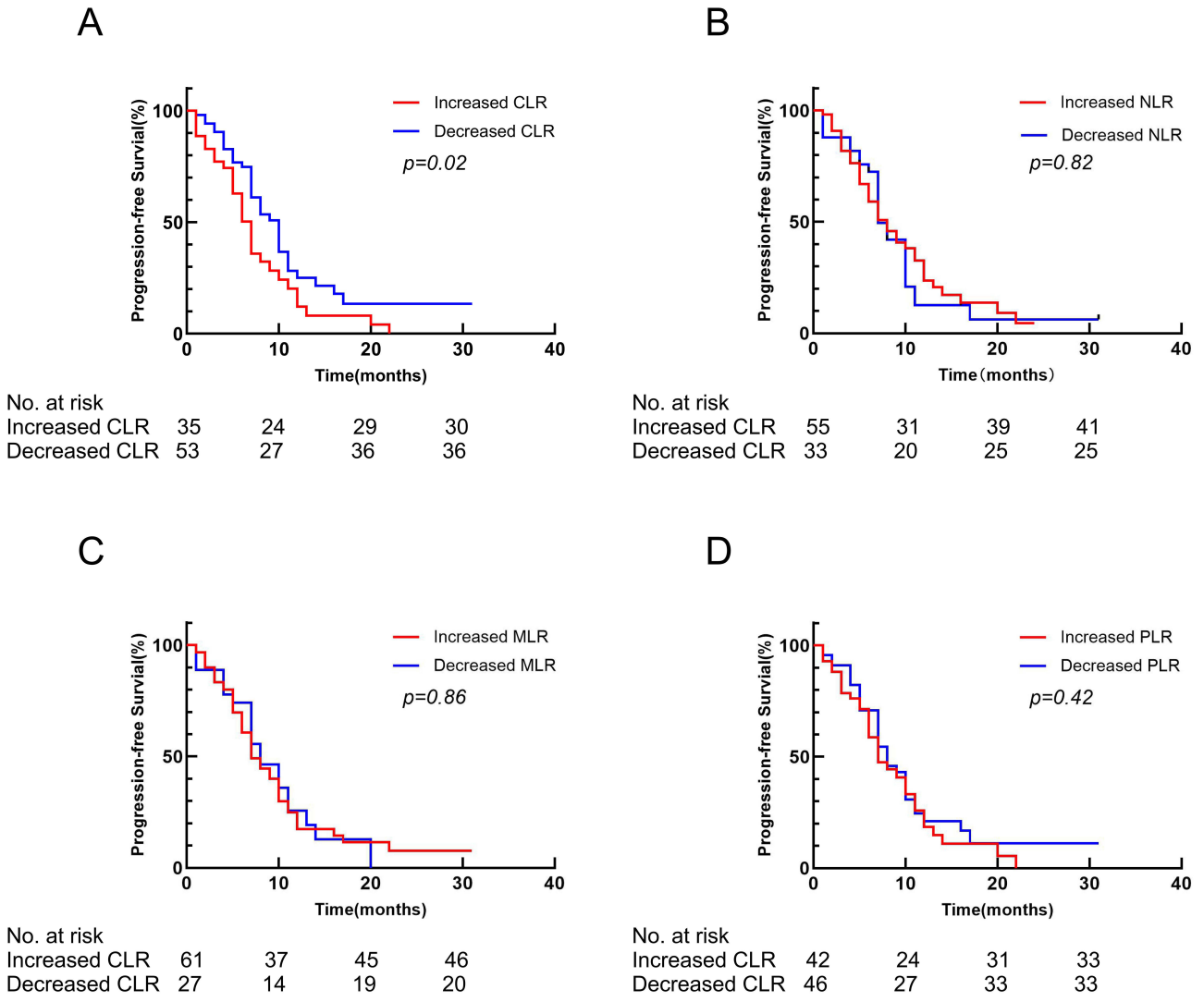

Figure 3 Kaplan-Meier progression-free survival curves according to (**A**) the decreased vs increased CLR groups; (**B**) the decreased vs increased NLR groups; (**C**) the decreased vs increased MLR groups; (**D**) the decreased vs increased PLR groups.

Reduction in CLR after chemoimmunotherapy was associated with a higher objective response rate and improved PFS. To determine the predictive value of CLR, ROC curves were used to identify the optimal cutoff value, which was found to be 2.47 at week 6. Patients were then categorized into two groups based on CLR at week 6: 52 patients had CLR <2.47, and 36 patients had CLR ≥2.47.

In the univariate analysis for PFS, no significant differences were detected with respect to patient age, ECOG performance status, line of treatment, brain metastases, other metastases, NLR, MLR, and PLR. However, a decreased CLR was associated with prolonged PFS (HR=0.61, 95% CI: 0.37–0.99, P=0.046). Patients with CLR <2.47 at time point 2 had significantly prolonged PFS (HR=1.99, 95% CI: 1.21–3.28, P=0.006). Liver metastasis was associated with shorter PFS (HR=0.51, 95% CI: 0.29–0.88, P=0.016), and bone metastasis was also associated with shorter PFS (HR=0.39, 95% CI: 0.22–0.67, P=0.001) (Table 3).

To identify independent predictors, a Cox multivariate analysis was performed. In the multivariate analysis, patients with CLR <2.47 at time point 2 were associated with prolonged PFS (HR=1.74, 95% CI: 1.05–2.89, P=0.032). Bone metastasis remained associated with shorter PFS (HR=0.44, 95% CI: 0.25–0.78, P=0.005), as shown in Table 3.

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Table 3 Univariate and Multivariate Analyses of Progression Free Survival

Variables	*N*	PFS Univariate		PFS Multivariate	
		HR (95% CI)	***P***	**HR (95% CI)**	***P***
Age(y)					
≥65	49	1		1	
<65	39	1.309 (0.799–2.144)	0.285	1.445 (0.873–2.391)	0.152
ECOG PS					
0-1 score	54	1		1	
≥2 score	34	1.581 (0.967–2.583)	0.068	1.448 (0.836–2.508)	0.187
Line of treatment					
≤2	78	1		1	
>2	10	1.249 (0.592–2.636)	0.559	0.882 (0.353–2.203)	0.788
Brain metastases					
Yes	23	1		1	
No	65	0.742 (0.430–1.281)	0.284	1.294 (0.682–2.455)	0.431
Liver metastases					
Yes	20	1		1	
No	68	0.51 (0.294–0.884)	0.016*	1.070 (0.477–2.400)	0.869
Bone metastases					
Yes	20	1		1	
No	68	0.386 (0.222–0.673)	<0.001*	0.44 (0.248–0.779)	0.005*
Other metastases					
Yes	25	1		1	
No	63	0.592 (0.338–1.035)	0.066	0.569 (0.323–1.002)	0.051
CLR					
Increase	35	1		1	
Decrease	53	0.609 (0.374–0.991)	0.046*	0.821 (0.47–1.431)	0.486
NLR					
Increase	55	1		1	
Decrease	33	1.017 (0.649–1.767)	0.788	1.079 (0.635–1.832)	0.779
MLR					
Increase	61	1		1	
Decrease	27	0.934 (0.551–1.767)	0.799	0.841 (0.482–1.469)	0.543
PLR					
Increase	42	1		1	
Decrease	46	0.836 (0.515–1.356)	0.467	0.898 (0.464–1.738)	0.749
6-week CLR					
<2.47	52	1		1	
≥2.47	36	1.994 (1.214–3.276)	0.006*	1.739 (1.048–2.886)	0.032*

Notes: *$p < 0.05$ are considered significant;
Abbreviations: PFS, progression free survival; HR, hazard ratio; CI, confidence interval.

Immune-Related Adverse Events

Immune-related adverse events (irAEs) emerged in 15 patients (17%), with hypothyroidism and pneumonia being the predominant conditions. No significant correlations were observed between irAEs and either ORR (P>0.05) or PFS. Grade 3 or 4 adverse events occurred in 4 (4.5%) of the 88 patients. Among these, three patients experienced grade 3 pneumonia, and one patient exhibited grade 3 abnormal kidney function.

Discussion

With robust data analysis, our results suggest that a decreased CLR is associated with better ORR and PFS in SCLC patients treated with PD-1/PD-L1 inhibitors combined with chemotherapy. Additionally, a specific post-therapy CLR value has potential as a predictive marker of response.

Various systemic inflammatory indexes have frequently been used as prognostic factors in lung cancer.[21–23] However, the optimal choice of composite indexes based on peripheral blood examination for predicting clinical benefits in SCLC patients remains uncertain.

Our comprehensive evaluation of inflammatory biomarkers revealed that CLR demonstrated statistically superior predictive value compared to NLR, MLR, and PLR. While these conventional ratios simply represent differential counts of peripheral blood cells, CLR provides a more physiologically relevant assessment by incorporating CRP - a well-established marker of systemic inflammatory burden. Importantly, NLR, MLR and PLR exhibit significant limitations in clinical practice due to their vulnerability to confounding variables, particularly chemotherapy-induced myelosuppression which directly alters their constituent cell populations.

As an acute-phase protein synthesized by hepatocytes, CRP is one of the most commonly used markers to reflect the systemic inflammatory response.[24] Tumor growth or invasion triggers an inflammatory response in the surrounding tissue and promotes the release of pro-inflammatory cytokines, leading to increased CRP production.[25] Lymphocytes play a pivotal role in the tumor microenvironment, with subtypes such as CD3+ T cells, CD8+ T cells, Th1 CD4+ T cells, and natural killer cells being essential for anticancer activity.[26] A high level of tumor-infiltrating lymphocytes surrounding the primary tumor site has been strongly associated with a favorable prognosis in SCLC.[27] Lymphopenia, often found in many human malignancies, correlates with disease severity, immunosuppression status, and poor survival outcomes.[28] Therefore, the increase in CLR, resulting from a decreased lymphocyte count and increased CRP level, indicates an impaired immunological response and a pro-tumor inflammatory status in the tumor microenvironment. This leads to tumor progression and a worse prognosis. As CLR can be measured quickly, noninvasively, and inexpensively, it is frequently used in clinical settings. This allows us to leverage our understanding of the systemic inflammatory response in cancer patients.

Little is known about the role of CLR in lung cancer. Nagano et al reported that pretreatment CLR is a valid prognostic marker for surgically resected NSCLC patients.[29] To our knowledge, this is the first study to investigate CLR in SCLC, particularly in the chemoimmunotherapy setting. Our findings suggest that dynamic changes in CLR may serve as a potential predictive biomarker for treatment response and prognosis, offering novel insights into patient stratification and therapeutic optimization in this aggressive malignancy. Specifically, CLR, by integrating CRP levels and lymphocyte counts, provides a more comprehensive reflection of the patient's inflammatory status and immune competence. This composite index could potentially guide clinical decision-making, helping to identify patients who are likely to benefit from PD-1/PD-L1 inhibitor and chemotherapy combination therapy. Future studies should aim to validate CLR as a prognostic and predictive biomarker and to explore its utility in different stages of SCLC and other malignancies.

However, the present study had some limitations. First, as a retrospective study conducted at a single institution, our analysis was limited by the relatively small sample size. Second, due to insufficient observation time, we could not collect mature overall survival (OS) data. Nevertheless, blood indicators can be monitored dynamically, allowing for the easy collection of subsequent data. Third, despite adjusting for major clinical and demographic confounders, our analysis may still be affected by unmeasured confounding. Finally, the cutoff value for inflammatory marker was derived empirically from our dataset, which requires external validation in independent cohorts. To address these limitations, larger multicenter prospective studies with balanced demographics are warranted.

Conclusion

In conclusion, our study found that CLR, which combines CRP and lymphocyte counts, is a feasible and predictive biomarker for the prognosis of patients with SCLC. Decreased CLR was associated with improved treatment outcomes in patients with SCLC treated with chemoimmunotherapy. Further research should focus on validating CLR in diverse clinical settings and exploring its utility in various stages of SCLC and other malignancies.

Data Sharing Statement

The data that support the results of this study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Clinical Research Ethics Committee of Beijing Chest Hospital (Approval No. LW-2025-012). Informed consent for treatment was required; however, written informed consent for enrolment into this study was not required, as this was a retrospective study. All patient data was treated with confidentiality.

Disclosure

The authors report no conflicts of interest in this work.

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