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CLINICAL PROFILE AND ASSOCIATION OF NEUTROPHIL-TO-LYMPHOCYTE RATIO WITH OUTCOMES IN PATIENTS WITH CHRONIC KIDNEY DISEASE: A CROSS-SECTIONAL STUDY

Viraj Sonone	Consultant Physician, Sonone Child Care & Critical Care Centre, Dwarka Nagari, Jawahar Nagar, Akola – 444001, Maharashtra, India
Nalini Humaney	Department of Medicine, NKP Salve Institute of Medical Sciences & Lata Mangeshkar Hospital (NKPSIMS & LMH), Nagpur, Maharashtra, India
Vibha Karande	Department of Pharmacology, Dr. D. Y. Patil School of Medicine, Navi Mumbai, Maharashtra, India
Tanuja Manohar	Department of Medicine, NKP Salve Institute of Medical Sciences & Lata Mangeshkar Hospital (NKPSIMS & LMH), Nagpur, Maharashtra, India
Shivaji Sonone	Consultant Intensivist, Jaslok Hospital and Research Centre, Mumbai, Maharashtra, India
Vaishali Thakare*	Professor, Department of Pharmacology, Dr. D. Y. Patil School of Medicine, Navi Mumbai, Maharashtra, India *Corresponding Author

ABSTRACT **Background:** Chronic kidney disease (CKD) is associated with significant morbidity and mortality. The neutrophil-to-lymphocyte ratio (NLR) has emerged as a simple marker of systemic inflammation. **Aim:** To evaluate the association between NLR, disease severity, and outcomes in patients with CKD. **Materials and Methods:** This cross-sectional study was conducted among 60 adult CKD patients at a tertiary care hospital between November 2022 and October 2024. Clinical and laboratory parameters were assessed, and associations between NLR and clinical outcomes were analyzed. **Results:** Elevated NLR was observed in 18.33% of patients. Significant associations were found between elevated NLR and serum creatinine, serum phosphorus, serum albumin, eGFR, triglycerides, and VLDL levels. Mortality was significantly higher among patients with elevated NLR than among those with normal NLR (45.45% vs. 10.20%; p=0.017). **Conclusion:** Elevated NLR was associated with worsening renal function and increased mortality in CKD patients. NLR may serve as a simple and cost-effective adjunctive marker for risk assessment in routine clinical practice.

KEYWORDS : Chronic Kidney Disease, Neutrophil-To-Lymphocyte Ratio, Inflammation, Mortality.

INTRODUCTION

Chronic kidney disease (CKD) is a major global health problem associated with substantial morbidity, mortality, and healthcare burden. It is characterized by progressive loss of kidney function and is commonly associated with hypertension and diabetes mellitus (Eknoyan et al., 2004; National Kidney Foundation, 2002). Patients with CKD are at increased risk of cardiovascular complications and premature mortality.

Inflammation plays an important role in CKD progression and its complications. The neutrophil-to-lymphocyte ratio (NLR), derived from routine complete blood count parameters, has emerged as a simple and inexpensive marker of systemic inflammation (Buonacera et al., 2022). Previous studies have demonstrated associations between elevated NLR, declining renal function, and adverse outcomes in CKD patients (Zhao et al., 2020; Yang et al., 2023).

However, data regarding the association between NLR and disease severity among Indian CKD patients remain limited (Aneez et al., 2024; Rashid et al., 2023). Therefore, the present study evaluated the association between NLR, biochemical parameters, disease severity, and outcomes in patients with CKD.

MATERIALS AND METHODS

This hospital-based observational cross-sectional study was conducted in the Department of General Medicine of a tertiary care hospital between November 2022 and October 2024 after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment.

A total of 60 adult patients aged 18 years and above with a confirmed diagnosis of chronic kidney disease (CKD) were included in the study. Patients with malignancy, acute or chronic infections, chronic inflammatory disorders, hematological diseases, those receiving immunosuppressive therapy, frequent users of non-steroidal anti-inflammatory drugs, and patients with a history of steroid use within the preceding six months were excluded.

Chronic kidney disease was defined according to the Kidney Disease: Improving Global Outcomes (KDIGO) 2012 Clinical Practice Guidelines as abnormalities of kidney structure or function persisting for more than three months (Kidney Disease: Improving Global Outcomes [KDIGO], 2013). Disease staging was performed using estimated glomerular filtration rate (eGFR) categories.

All participants underwent detailed clinical evaluation, including history taking and physical examination. Blood pressure was recorded in the sitting position after five minutes of rest. Laboratory investigations included complete blood count, erythrocyte sedimentation rate, serum electrolytes, blood urea, serum creatinine, serum calcium, serum phosphorus, serum uric acid, serum alkaline phosphatase, serum albumin, glycated hemoglobin (HbA1c), and lipid profile. Estimated glomerular filtration rate was calculated using the CKD-EPI equation.

The neutrophil-to-lymphocyte ratio (NLR) was calculated by dividing the absolute neutrophil count by the absolute lymphocyte count. Patients were categorized into elevated and normal NLR groups using a cutoff value of 3.53.

Data were analyzed using appropriate descriptive and inferential statistical methods. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were expressed as frequencies and percentages. Associations between NLR and demographic,

biochemical, and outcome variables were assessed using Student's t-test and Chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 60 patients with chronic kidney disease were included in the study. Demographic characteristics and comorbidities of the study population are summarized in Table 1.

Table 1: Demographic Information

Demographic information		Number of subjects	Percentage
Age distribution	18 to 35 years	3	5.00
	36 to 45 years	5	8.33
	46 to 55 years	23	38.33
	56 to 65 years	20	33.33
	More than 65 years	9	15.00
Gender-wise distribution	Males	37	61.67
	Females	23	38.33
Comorbidities	Diabetes mellitus	11	18.33
	Hypertension	16	26.67
	Glomerulonephritis	7	11.67

The distribution of CKD stages and NLR categories is presented in Table 2. Elevated neutrophil-to-lymphocyte ratio (NLR >3.53) was observed in 18.33% of patients.

Table 2: Distribution of GFR Categories and NLR

		Number of subjects	Percentage
GFR categories	G3a	9	15.00
	G3b	18	30.00
	G4	26	43.33
	G5	7	11.67
Distribution of NLR	High	11	18.33
	Normal	49	81.67

No statistically significant association was observed between NLR and demographic variables including age group, gender, body mass index, and socioeconomic status (p>0.05) (Table 3)

Table 3: Association Between Demographic Parameters and NLR

Variable		In-flammatory status (NLR > 3.53) n = 11 (%)	In-flammatory status (NLR ≤ 3.53) n = 49 (%)	P value
Age groups (years)	Adult (< 60)	63.6	57.1	0.491
	Elderly (≥ 60)	36.4	42.9	
Gender	Male	54.5	55.1	0.331
	Female	45.5	44.9	
BMI	Underweight	18.2	8.2	0.715
	Normal	36.4	49	
	Overweight	27.3	34.7	
	Obese	18.2	10.2	
Socio-economic status	Lower	45.5	46.9	0.495
	Middle	36.4	32.7	
	Upper	18.2	20.4	

Analysis of biochemical parameters demonstrated significant associations between elevated NLR and systolic blood pressure, serum sodium, blood urea, serum creatinine, serum calcium, serum phosphorus, estimated glomerular filtration rate (eGFR), serum albumin, and hemoglobin levels (p<0.05). No significant association was observed with diastolic blood pressure, potassium, uric acid, alkaline phosphatase, or HbA1c levels (Table 4).

Among lipid profile parameters, triglyceride and very-low-density lipoprotein (VLDL) levels showed significant associations with elevated NLR, whereas total cholesterol, HDL cholesterol, and LDL cholesterol did not (Table 4).

Table 4: Comparison Between Various Biochemical Parameters with NLR

Variables	Overall mean ± SD (n=60)	NLR High (n=11)	NLR Normal (n=49)	p value
Age (years)	53.6 ± 14.5	53.9 ± 13.4	54.0 ± 14.1	0.534
BMI (kg/m ^ 2)	24.1 ± 4.5	23.1 ± 4.7	24.2 ± 4.1	0.279
SBP (mmHg)	149.5 ± 24.8	154.1 ± 23.8	147.9 ± 24.7	0.036
DBP (mmHg)	88.0 ± 13.6	89.2 ± 12.6	87.6 ± 15.2	0.700
Sodium (mg/dL)	139.4 ± 6.0	138.6 ± 4.7	139.7 ± 5.6	0.014
Potassium (mEq/L)	5.3 ± 0.7	5.3 ± 0.9	4.5 ± 0.5	0.162
Urea (mg/dL)	77.4 ± 41.7	88.8 ± 52.5	73.1 ± 36.7	0.011
Creatinine (mg/dL)	2.6 ± 2.4	3.0 ± 4.5	1.8 ± 4.3	0.041
Calcium (mg/dL)	9.6 ± 1.1	9.2 ± 0.9	9.3 ± 1.4	0.04
Phosphorus (mg/dL)	4.2 ± 1.5	4.8 ± 1.5	3.8 ± 1.2	0.001
Uric acid (mg/dL)	7.9 ± 1.7	7.1 ± 2.1	7.3 ± 1.8	0.992
ALP (U/L)	108.6 ± 44.9	115.7 ± 59.3	105.7 ± 37.0	0.056
eGFR (ml per min/1.73 m ^ 2)	33.4 ± 15.4	30.2 ± 12.7	34.1 ± 16.9	0.022
Serum albumin (g/dL)	3.8 ± 0.4	3.9 ± 0.3	4.0 ± 1.0	≤ 0.005
HbA1c (%)	7.0 ± 2.0	7.4 ± 1.9	6.9 ± 1.4	0.91
Hemoglobin (g/L)	10.9 ± 2.3	10.3 ± 2.1	10.9 ± 2.0	0.024
TC (mg/L)	180.1 ± 56.8	179.1 ± 65.8	180.4 ± 52.0	0.818
TG (mg/L)	158.9 ± 72.8	146.9 ± 55.2	163.8 ± 78.7	0.03
HDL-c (mg/L)	45.7 ± 15.3	48.5 ± 20.1	45.1 ± 12.2	0.093
LDL-c (mg/L)	100.8 ± 43.5	100.5 ± 50.3	100.9 ± 43.0	0.868
VLDL (mg/L)	35.1 ± 28.2	30.2 ± 11.2	37.0 ± 32.3	0.05

A statistically significant association was observed between elevated NLR and patient outcomes. Mortality was higher among patients with elevated NLR than among those with normal NLR values (45.45% vs. 10.20%; Chi-square = 5.70, p = 0.017) (Table 5).

Table 5: Association Between Outcomes and NLR

Outcomes	High NLR		Normal NLR	
	Number	Percentage	Number	Percentage
Death	5	45.45	5	10.20
Discharged	6	54.55	44	89.80

DISCUSSION

The present study evaluated the association between neutrophil-to-lymphocyte ratio (NLR) and clinical outcomes in patients with chronic kidney disease (CKD). The findings demonstrated that elevated NLR was associated with worsening renal function, adverse biochemical parameters, and increased mortality, supporting the role of systemic inflammation in CKD progression (Buonacera et al., 2022).

The majority of participants were middle-aged males, and

hypertension and diabetes mellitus were the most common comorbidities. These findings are consistent with previous studies identifying these conditions as major contributors to CKD development and progression (National Kidney Foundation, 2002; Aneez et al., 2024).

Most patients were classified as CKD stage G4, indicating advanced renal dysfunction. Elevated NLR was more frequently observed among patients with advanced CKD stages. Similar findings have been reported by Rashid et al. (2023) and Okyay et al. (2013), who demonstrated an association between elevated NLR and worsening renal function.

Significant associations were observed between elevated NLR and blood urea, serum creatinine, serum phosphorus, serum albumin, hemoglobin levels, and estimated glomerular filtration rate (eGFR). These findings suggest that elevated NLR reflects greater inflammatory burden and poorer renal function. Similar observations were reported by Zhao et al. (2020) and Han et al. (2022).

Elevated NLR was also associated with triglyceride and VLDL levels, supporting the relationship between systemic inflammation and metabolic abnormalities in CKD (Rashid et al., 2023; Aneez et al., 2024).

Mortality was significantly higher among patients with elevated NLR. Similar observations have been reported by Zhao et al. (2020) and Yang et al. (2023), suggesting that elevated NLR may be a useful indicator of poor prognosis among CKD patients.

As NLR can be derived from a routine complete blood count without additional cost, it may serve as a simple and readily available adjunctive marker for risk assessment, particularly in resource-limited settings.

CONCLUSION

Elevated neutrophil-to-lymphocyte ratio (NLR) was associated with worsening renal function, adverse biochemical parameters, and increased mortality among patients with chronic kidney disease. As an inexpensive and readily available inflammatory marker, NLR may serve as a useful adjunct in risk assessment and clinical evaluation of CKD patients. Further prospective studies are required to establish its prognostic utility.

Limitations of the Study

The study was limited by its small sample size, single-center design, and cross-sectional methodology. Causal relationships and long-term outcomes could not be assessed. Larger multicentric prospective studies are required to validate the findings.

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Nil.

Conflicts of Interest

There are no conflicts of interest.

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