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ORIGINAL ARTICLE

Could Neutrophil-Lymphocyte Ratio or Platelet Lymphocyte Ratio Have a Role in Urgent Dialysis Decision?

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Abstract

Introduction: Chronic kidney disease (CKD) is the chronic and progressive deterioration of metabolic and endocrine functions together with the inability to adjust the fluid-solute balance of the kidney. In our study, the values of neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) before and after dialysis were compared in patients with chronic renal failure, except for patients with infection clinic admitted to the emergency department. Our aim is to examine the changes in the parameters of complete blood count (hemogram) before and after dialysis, which is a fast and inexpensive test, to discuss whether these changes will give an idea in determining the need for urgent dialysis.

Methods: The CKD patients who received a routine dialysis program in the Nephrology Clinic Dialysis Unit of Istanbul Haydarpaşa Numune Training and Research Hospital were examined. Among the patients with CKD who received routine dialysis in our hospital, patients who presented to the emergency department for various reasons between January 2016 and January 2018 were included in our study. Laboratory examinations were made with MINDRAY BC6800 brand hemogram device. As a statistical analysis, the mean values, standard deviations, median values of the data were calculated. Student's t-test was used to compare the Chi-square test variants.

Results: Between January 2016 and January 2018 a total of 458 CKD patients applied to our emergency department. The pre-dialysis and post-dialysis NLR ratios of the patients show a statistically significant change in all age groups ($p<0.05$). Post-dialysis values in patients over 52 years of age in PLR ratios decreased significantly compared to pre-dialysis values ($p<0.05$). On the other hand, there was no statistically significant change in PLR ratios in patients under 52 years of age.

Discussion and Conclusion: In determining the need for urgent dialysis, the increase in NLR and PLR ratios can be helpful in making an emergency dialysis decision together with clinical evaluation.

Keywords: Neutrophil/lenfosit ratio; platelet/lenfosit ratio; urgent dialysis.

Acute kidney injury (AKI) is the acute loss of kidney functions, which is caused by an increase in serum creatinine and/or variation in the amount of urine[1]. Chronic kidney disease (CKD) a chronic and progressive failure of metabolic and endocrine functions along with the kidney's inability to maintain fluid/solute balance, which is caused by renal or systemic diseases and harmful to the kidney.

Contrary to the course of AKI, in CKD, kidney damage is rarely repaired, but the loss of function persists. CKD is described as the deterioration in the renal structure and func-

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tions, which persists for more than 3 months[2]. CKD is a public health problem with high morbidity, mortality, and cost due to its increasing incidence[3].

Patients with kidney disease are frequently admitted to the emergency department. In a 1-year study, Demircan et al.,[4] found that 20% of patients referred from the emergency department to the internal medicine ward were then referred to the nephrology service and the most common cause of referral was CKD.

Indications for urgent dialysis mostly include uncontrolled hyperkalemia, uremic lung, uremic pericarditis, progressive uremic encephalopathy, bleeding dyscrasia secondary to uremia, deep hyponatremia or hypernatremia, severe metabolic acidosis resistant to sodium bicarbonate, some intoxications, and high blood urea nitrogen level.[5-7] Resistant fluid overload (pulmonary edema) and hypertension are also among the indications of urgent dialysis. In CKD patients admitted to the emergency department, the indication for dialysis often depends on the clinical decision of the emergency department and consultative physician, thereby diminishing the importance of quantitative values.

The neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) are simple and inexpensive laboratory values obtained by dividing the numbers of neutrophils and platelet by the number of lymphocytes. Studies have shown that NLR may be associated with high cardiovascular mortality in patients receiving dialysis[8].

The past studies showed NLR and PLR at diagnosis could predict renal outcomes in patients with CKD[9]. Lots of diseases that have a significant change on NLR have been mentioned[9,10]. The normal value of NLR was described as 2.9±1.8 for male and 2.8±1.7 for female patients. In the same study for PLR 153±63 for male and 118.8±61 for female has been found[11]. Due to age, NLR was found 2.7±1.5 for 18–50 years old patients and 3.1±2.2 was found for 51–85 years old patients. When we look for PLR 113.0±32.0 for 18–50 and 151.0±49.9 for 51–85 years old patients[11]. The same values were used in our study.

In this study, we compared pre-dialysis and post-dialysis NLR and PLR values in CKD patients admitted to the emergency department, except for those with an infectious disease. Our aim was to examine the changes in pre-dialysis and post-dialysis parameters in the complete blood count (hemogram), which is a fast and inexpensive test, and to discuss whether these changes give clinicians insights into determining the need for urgent dialysis.

Materials and Methods

We examined the emergency admissions between January 2016 and January 2018 of CKD patients who were given a routine dialysis treatment at the Dialysis Unit of the Nephrology Clinic of the Haydarpasa Numune Training and Research Center in Istanbul. The following variables were recorded: patients' age, sex, and reasons for emergency admissions, the season of admission, and on-admission and post-dialysis neutrophil, lymphocyte, platelet, NLR, and PLR values.

The hemogram parameters in the first blood samples on admission and the first blood samples after dialysis were used in the analysis. All blood samples from the patients were tested using the same device and in the same laboratory. Laboratory examinations were carried out using Mindray BC-6800 Auto Hematology Analyzer.

The study included patients aged between 18 and 90 years who were diagnosed with CKD and were receiving hemodialysis at least twice a week for at least 3 months. The exclusion criteria were being under age 18, diagnosed heart failure, coronary artery syndrome, cerebrovascular event, malignancy, or autoimmune disease. Furthermore, elevated C-reactive protein (CRP), procalcitonin (PCT) have mentioned as exclusion criteria. The exclusion has been done by patients last medical records and blood test results.

Mean and median values and standard deviations were used in the statistical analysis. Student's t-test and Chi-squared test were used to compare the variables.

Results

A total of 458 CKD patients were admitted to our emergency department for different reasons between January 2016 and January 2018. 124 patients had infection symptoms and signs such as fever and elevated CRP, leukocyte, and PCT levels. Forty-three patients had a history of aspirin use. 108 patients had a history of coronary artery disease or cerebrovascular disease. 31 patients had a diagnosis of malignancy. A total of 306 patients with at least one of the above-mentioned exclusion criteria were not included in the study. In addition, 50 patients were not included in the study due to incomplete or inconsistent data. As a result, a total of 102 patients were included in the study.

Among them, 52.9% (n=54) were female and 47.1% (n=48) were male. The patients' age ranged between 26 and 94 years and the mean age was 62.85 (Table 1). Among the patients 31.3% (n=32) were admitted to the emergency de-

Table 1. Hemogram parameters of patients

Variables	(1) n	(2) Mean	(3) SD	(4) Min	(5) Max	(6) Median	(7) IQR	(8) CV
Age	102	62.85	15.46	26	94	65	24	0.25
NEU1	102	5.945	1.867	0.660	9.400	5.95	2.92	0.31
LEN1	102	1.162	0.617	0.250	3.930	1.07	0.86	0.53
PLT1	102	188.9	70.23	57	470	183.5	79	0.37
NEULEN1	102	6.919	5.149	1.535	26.34	4.95	5.18	0.74
PLTLEN1	102	205.3	143.8	66.81	955.2	157.72	136.83	0.70
NEU2	102	5.075	1.763	0.780	9.230	5.09	2.23	0.35
LEN2	102	1.349	0.683	0.390	4.360	1.28	0.97	0.51
PLT2	102	186.2	69.42	60	418	171	81	0.37
NEULEN2	102	4.970	3.796	0.448	22.03	3.70	4	0.76
PLTLEN2	102	168.6	102.5	45.90	695.2	139.41	110.70	0.608

n: Number of observation; SD: Standard deviation; Min: Minimum; Max: Maximum; IQR: Interquartile range (0.25–0.75); CV: Coefficient of variation; NEU1: Pre-dialysis neurophil count; LEN1: Pre-dialysis lymphocyte count; PLT1: Pre-dialysis platelet count; NEULEN1: Pre-dialysis neurophil/ lymphocyte count; PLTLEN1: Pre-dialysis platelet/lymphocyte ratio; NEU2: Post-dialysis neurophil count; LEN2: Post-dialysis lymphocyte count; PLT2: Post-dialysis platelet count; NEULEN2: Post-dialysis neurophil/ lymphocyte ratio; PLTLEN2: Post-dialysis platelet/lymphocyte ratio.

partment in the summer, 27.5% (n=28) in the winter, 23.5% (n=24) in the spring, and 17.7% (n=18) in the autumn.

With respect to the reasons for emergency admissions; 36.2% (n=37) of the patients were admitted due to the delays in their dialysis routine, 25.4% (n=26) due to the complaints of nausea, vomiting, and asthenia, 20.5% (n=21) due to catheter or fistula problems, 11.7% (n=12) due to dyspnea, and 5.8% (n=6) due to abdominal pain.

The patients mean pre-dialysis NLR value was found 6.919 and PLR was 205.3, the post-dialysis mean NLR was 4.970 and for PLR it was found 168.6. Patients' pre- and post-dialysis NLR differed statistically significantly across all age groups ($p<0.05$) (Table 2). There was a significant decrease in the post-dialysis PLR of patients aged over 52 years compared to their pre-dialysis values ($p<0.05$). On the other hand, there was no statistically significant change in the PLR of patients below the 5th decade (Table 3).

Discussion and Conclusion

In this study, we have shown that NLR and PLR can be used as a marker in predicting the indication for urgent dialysis in CKD patients. NLR is a systemic marker that informs about the association between inflammation and physiological stress. NLR is calculated by dividing the number of neutrophils which increases in acute inflammation by the number of lymphocytes which decrease due to physiological stress and can be used as a marker of inflammatory diseases and acute to chronic systemic inflammation, albeit with ethnic differences[12]. The normal rate of mean NLR is found (1.65±1.96 SD:0.78–3.53) (95% CI [0.75–0.81] and [3.40–3.66]) in a study that tries to identify that[13].

Table 2. NLR results of patients

	n	Mean	NLR1=NLR2 p	NLR1>NLR2 p	NLR1<NLR2 p
Entire Sample					
NLR1	102	6.92	0.0000***	1.000	0.000***
NLR2	102	4.97			
<5th decade					
NLR1	24	4.35	0.0193***	0.9903	0.0097***
NLR2	24	3.05			
5th–6th decade					
NLR1	26	7.10	0.0067***	0.9966	0.0034***
NLR2	26	5.70			
6th–7th decade					
NLR1	25	9.61	0.0010***	0.9995	0.0005***
NLR2	25	5.83			
>7th decade					
NLR1	27	6.53	0.0008***	0.9996	0.0004***
NLR2	27	5.17			

NLR: Neutrophil/lymphocyte ratio.

PLR was evaluated in relation to various diseases and cardiovascular risk factors[14]. Patients with kidney disease have higher predicted PLR mortality and cardiovascular

Table 3. PLR results of patients

	n	Mean	PLR1=PLR2 p	PLR1>PLR2 p	PLR1<PLR2 p
Entire sample					
PLR1	102	205.33	0.0004****	0.9998	0.0002****
PLR2	102	168.60			
<5th decade					
PLR1	24	145.60	0.2754	0.8623	0.1377
PLR2	24	134.27			
5th–6th decade					
PLR1	26	191.37	0.0152**	0.9924	0.0076***
PLR2	26	168.41			
6th–7th decade					
PLR1	25	284.26	0.0190**	0.9905	0.0095***
PLR2	25	194.75			
>7th decade					
PLR1	27	198.79	0.0199**	0.9901	0.0099***
PLR2	27	175.09			

PLR: Platelet to lymphocyte ratio.

events[15]. PLR can be used along with NLR as a reliable indicator of systemic inflammation because platelet aggregation plays an important role in the pathogenesis of many diseases and inflammatory events.

Elevated NLR and PLR are associated with increased mortality and poor prognosis in hemodialysis patients and patients with acute coronary syndrome and malignancy and can be used as early markers in some diseases, especially cardiovascular diseases[16-18].

CKD is associated with high morbidity and mortality, especially due to recent kidney disease, cardiovascular disease, and infection. This may also be associated with chronic inflammation. Abe et al.,[19] showed that elevated levels of NLR at the onset of dialysis treatment in CKD patients may be associated with cardiovascular diseases. An increased neutrophil count and decreased lymphocyte count in hemodialysis patients have been shown to predict mortality based on the relationship between cardiovascular mortality and CKD[20,21]. NLR and PLR are reliable measures of systemic inflammation[22]. While the mechanisms by which systemic inflammation and elevated NLR cause cognitive dysfunction are still unknown, in a study in 2010, Gorelick et al.,[23] emphasized that inflammation is an important factor in the neuropathological steps of dementia and cognitive dysfunction development. In a study in 2016, Tatar et al.,[24] noted that elevated NLR and PLR gave clues about poor prognosis in CKD patients.

The past studies showed NLR and PLR at diagnosis could predict renal outcomes in patients with CKD[9]. Lots of diseases that have a significant change on NLR have been mentioned[9,10].

Considering the time of emergency admission of our patients, the highest need for urgent dialysis was observed in the summer and the lowest need was in the spring. Further research in a larger patient population is needed to prove a statistically significant difference in the need for urgent dialysis between the seasons. Increased fluid intake due to electrolyte imbalance or dehydration caused by high temperature in the summer results in overload, which may be the main reason for the need for urgent dialysis.

In our study, elevated NLR in all patients aged over 18 years and elevated PLR in all patients aged over the 5th decade were significant in predicting the need for urgent dialysis. Hemogram is a test that delivers fast results and provides a fast count of neutrophils, lymphocytes, and platelets, thereby facilitating the calculation of NLR and PLR in a short time. Thus, we believe that it helps determine the need for urgent dialysis at an early stage. CKD patients who receive routine dialysis often undergo dialysis in the same center, except for holidays, travels, or unexpected situations; thus, it is convenient to reach their former examination results. In line with the findings of the study, elevated NLR and PLR together with clinical evaluation may help make a decision on urgent dialysis.

We found that among the CKD patients who were admitted to the emergency department and found to need dialysis treatment, NLR was increased in all patients aged over 18 years and PLR was increased in all patients aged over 5th decade. Accordingly, elevated NLR and PLR, along with clinical evaluation and other formerly used indicator parameters of urgent dialysis, may give clinicians insights into determining the indication for urgent dialysis at the early stage. More extensive studies are needed to obtain statistically significant results.

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