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The Effect Of Blood Parameters On Emergency Department Follow-Up Time And Hospitalization Status In COPD

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory disease of the airways and lungs. Neutrophils are the blood cells that respond most early to inflammation. In many studies, the Neutrophil/Lymphocyte ratio has been shown to be an important component of the inflammatory response. RDW is a routine component of the hemogram, which shows heterogeneity in erythrocyte size and is used as a laboratory value for anemia. Research has shown that high RDW can be used as an indicator of poor prognosis in COPD. We aimed to show the effect of NLR and RDW values on morbidity by examining the correlation with length of hospital stay in COPD patients.

Methods: Complete blood count data and length of hospital stay of COPD patients who were admitted to the emergency department of our hospital with symptoms of COPD exacerbation in the last six months were investigated retrospectively. The relationship between RDW values in complete blood count and neutrophil/lymphocyte ratios (NLR) in the emergency department and inpatient admission rates was examined.

Result: A total of 101 patients, 69.3% of whom were male, were diagnosed with COPD and admitted to the emergency department with acute respiratory failure were included in the study. As a result of the statistical study, there is a significant difference in RDW-SW and NLR values according to the length of stay in the emergency department.

Conclusion: In our study, we observed that patients with higher RDW and NLR values had longer hospital stays. This has shown that RDW and NLR measurements may be important in determining the morbidity of the disease..

Keywords: COPD, COPD exacerbation (AECOPD), NLR, RDW, Length of hospital stay (LOS).

Introduction

Chronic obstructive pulmonary disease (COPD) is a chronic, progressive inflammatory disease of the small airways, alveolar epithelium and pulmonary endothelial cell, characterized by permanent limitation of airflow, usually as a result of exposure to toxic gases or particles (1,2). According to statistics, COPD is the third leading cause of death in the world and affects one-tenth of the global population (3). Exacerbation of COPD, on the other hand, negatively affects the current health status of patients by increasing the hospitalization rate and length of hospital stay (4). The 5-year mortality rate in patients hospitalized with the diagnosis of COPD exacerbation is approximately 50% (2). Considering that hospitalization due to exacerbation increases mortality in patients with COPD, there is a need for inexpensive biomarkers that can be easily used to predict attack frequency, length of hospital stay (LOS) and mortality (2). There is a growing number of researchers who attach importance to the use of biomarkers in COPD. Biomarkers are objective indicators that can be used to distinguish between the normal state and the diseased state or to determine the response and effectiveness of the treatments given (3).

Red blood cell distribution width (RDW), which is used as an important parameter in the differential diagnosis of anemia, reflects the degree of heterogeneity in erythrocyte volume (5). RDW is calculated by dividing the SD (standard deviation) in red blood cell (RBC) size by the mean corpuscular volume (6). It is a well-known, simple and cost-effective hematological parameter that is present within the complete blood count (1). The size of RDW is standard, but conditions such as inflammation, ineffective erythropoiesis, nutritional deficiencies, and bone marrow dysfunction result in a higher RDW size (7). Some clinical studies have shown that RDW is associated with a variety of diseases and disease outcomes, can be considered a strong independent risk factor for mortality in the general population, and can be used to predict mortality in critically ill patients (5,6). These studies have reported that high

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levels of RDW may reflect underlying chronic inflammation (7). The most well-known factors in COPD are increased inflammation in the lungs and a systematic inflammatory response. Many inflammatory markers have been shown to be systemically elevated in COPD. Inflammation associated with COPD, like other chronic inflammatory processes, can disrupt erythropoiesis and increase RDW (7). Some studies have shown that patients with stable COPD and COPD acute exacerbation (AECOPD) have higher RDW levels compared to healthy individuals (8,9).

In our study, we analyzed whether there was a correlation between the parameters in the complete blood count in the blood samples taken at the time of admission and the length of stay in the emergency department and the hospitalization status of the patients admitted to the emergency department due to exacerbation of COPD.

Materials And Methods

This study was prepared by retrospectively examining patients diagnosed with COPD who were admitted to the emergency department of Istanbul Göztepe Prof. Dr. Süleyman Yalçın City Hospital between June 15, 2024 and December 15, 2024 as outpatients and/or with the 112 ambulance system. A total of 101 patients were included in the study. The cases in our study consisted of patients who were previously diagnosed with COPD by a pulmonologist, had an ICD code entry of j44.9 in the hospital system, and applied to the emergency department with acute respiratory distress. The results of the blood samples taken at the time of admission of the patients included in the study were examined and the Neutrophil, Lymphocyte, RDW-SD and RDW-SW values in the complete blood count were taken into consideration. Patients were evaluated according to age, gender, NLR (Neutrophil/Lymphocyte Ratio), RDW-SD and RDW-SW values, length of stay in the emergency department and hospitalization. The epicrises and data of the patients were scanned, and the duration of hospitalization in the inpatient service, and the duration of stay in the emergency department of the patients who were not hospitalized and discharged as outpatients were noted.

Exclusion Criteria

Patients under 18 years of age, patients who were not previously diagnosed with COPD by a pulmonologist and not registered in the hospital system with the ICD code j44.9, patients with active malignancies, patients with asthma and interstitial lung disease, and patients with acute congestive heart failure were not included in the study.

Statistical Analysis Methods

Descriptive statistics (mean + standard deviation, median (minimum-maximum)) values are given to define continuous variables. The conformity of continuous variables to normal distribution was examined by Shapiro Wilks test. 2 groups that did not conform to the independent normal distribution were examined with the continuous variable Mann Whitney u test. The correlation between 2 variables that do not conform to continuous, normal distribution was examined with the Spearman Rho Correlation coefficient. The statistical significance level was determined as 0.05. The analyses are available in MedCalc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2013)

Results

A total of 101 patients diagnosed with COPD and admitted to the emergency department with acute respiratory failure were included in the study. Of the COPD exacerbation patients included in the study, 69.3% were male and 31.7% were female. The mean age of these patients was 69.7 years (Table 1).

Table 1: Demographic data of patients

	N	%
Gender		
Male	69	69,3
Female	32	31,7
	Avg±SS	**Med(min-max)**
Age	69.7±12.3	70

46.5% of the COPD patients who came to the emergency department were discharged between 0-6 hours and 7.9% after receiving treatment in the emergency department between 6-12 hours. 45.6% were admitted to the inpatient service of the hospital (Table 2).

Table 2: Length of hospital stay of patients

	N		%
Emergency Service 0-6 hours		47	46,5
Emergency Service 6-12 hours	8		7,9
Inpatient Service (Pulmonology Service)	46		45,6
Sum	56		100

RDW-SW and NLR values showed statistically significant differences according to the length of stay in the emergency department. Although there is no statistically significant difference between RDW-SD and length of stay (LOS), it is seen that the value is higher in patients with long stay (Table 3).

Table 3: Relationship between RDW-SW, RDW-SD and NLR values and follow-up time and hospitalization status in the emergency department

	0-6 hours n=47	6-12 hours n=8	Hospitalization n=46	p
RDW-SW				0,015
Avg±SS	14.7±1.3	15.2±1.8	16.1±3.1	
Med(min-max)	14,4 (12,6-18,5)	15,9 (11,5-16,8)	15,4 (12,7-30)	
RDW-SD				0,159
Avg±SS	51.6±4.2	52.9±3.9	54.4±8	
Med(min-max)	52 (42-63)	53 (45-59)	53 (40-85)	
NLR				0,002
Avg±SS	4.6±4.3	7.7±7.4	10.8±11.1	
Med(min-max)	4 (1-27,2)	5,1 (2,5-25)	5,9 (1,4-42,4)	

Kruskal Wallis test

According to the Post Hoc comparison result; A statistically significant difference was found in RDW-SW and NLR values between 0-6 hours and hospitalization groups.

Post Hoc Comparisons

	RDW-SW p	NLR p
0-6 hours / 6-12 hours	0,421	0,385
0-6 hours / Hospitalization	**0,015**	**0,002**
6-12 hours / Hospitalization	1,00	1,00

In our study, we also examined whether RDW-SW, RDW-SD and NLR levels are correlated with each other. According to the result, there is a moderate and statistically significant correlation between RDW-SW with RDW-SD. There is a weak and statistically significant correlation between RDW-SW with NLR and RDW-SD with NLR (Table 4).

Table 4: Correlation Between RDW-SW, RDW-SD, and NLR

		RDW-SW	RDW-SD	NLR
RDW-SW	**Correlation Coefficient**	1.000	**.663****	**.304****
	Sig. (2-tailed)	.	**<,001**	**.002**
	N	101	101	**101**
RDW-SD	**Correlation Coefficient**	.663**	1.000	**.209***
	Sig. (2-tailed)	<,001	.	.036
	N	101	101	101
NLR	**Correlation Coefficient**	.304**	.209*	1.000
	Sig. (2-tailed)	.002	.036	.
		101	101	101

Discussion

Some studies have shown that high levels of RDW are linked to the inflammatory process and oxidative stress (10). As a result of the inflammation that occurs, iron metabolism and bone marrow function are affected, and erythrocytes induced by erythropoietin cannot mature. Thus, immature red blood cells are released into the circulation, leading to an increase in RDW. Oxidative stress has a significant impact on erythrocyte homeostasis and survival (5). It is possible that oxidative stress contributes to the elevation of RDW, possibly by accelerating the transformation of erythrocytes, and thus plays a role in anisocytosis and pathological conditions (5,10).

Şahin et al. evaluated the RDW values between stable COPD, COPD exacerbation and healthy control group and found that RDW values were high in COPD exacerbation patients, and in this study, it was found that RDW values were increased in patients presenting with mild exacerbations that could be managed in the outpatient clinic. However, in this study, decreased RDW values were determined in moderate and severe COPD exacerbations requiring admission to the ward and ICU (11).

Although RDW has been found to be effective in many studies evaluating the effect of RDW on mortality in COPD patients, there are also studies showing that there is no correlation with mortality. In a study conducted by Rahimirad et al. on 330 patients, it was found that high RDW values at admission were associated with in-hospital mortality in patients hospitalized for COPD exacerbation (12). In another study, a retrospective analysis of 270 patients with stable COPD found that high RDW levels were associated with an increased risk of mortality. In the same study, there was a correlation between RDW levels and CRP, suggesting that RDW may be a marker in systemic inflammatory response in patients with COPD (7). In the study conducted by Tertemiz et al., it was found that the average RDW levels increased with the severity of COPD. When the patients were divided into 2 groups according to RDW, the 9-year survival rate was found to be 75% for patients with normal RDW and 31% for patients with high RDW. In addition, in the same study, it was observed that pulmonary function test parameters were negatively correlated with RDW. In addition, a relationship between smoking intensity and RDW levels has been mentioned,

which may be due to erythropoiesis due to hypoxemia (13). Another study likewise found that smokers had higher RDW levels than those associated with non-smokers (14).

In the study conducted by Eraslan et al., there was no significant correlation between the RDW/albumin ratio measured at admission and 30-day mortality in patients hospitalized for exacerbation of COPD (2).

There are several articles in the literature that measure the correlation of RDW value with coronary artery disease. In the study conducted by Liu et al., it was shown that there is a linear relationship between RDW and cardiovascular disease mortality in patients with COPD (5). In the study of Bai et al., RDW and MPV values were evaluated in COPD patients with pulmonary heart disease, and it was found that high RDW values were associated with the severity of COPD (15). Ren et al. examined 1,442 Chinese patients with stable angina pectoris and found that RDW was significantly associated with both mortality and acute coronary syndrome (ACS) (16).

RDW-SD and RDW-CV levels were significantly increased in COPD and pulmonary embolism patients in the study group of Wang et al. compared to those in the control group. Considering the contribution of RDW-SD to the risk factors of PE, it was found to be associated with a 1,188-fold increase in PE risk (17). Specific et al. showed that RDW values were higher in the COPD group than in the controls (18).

Similar to the result we found in our study, Kim et al. showed that the increase in RDW was significantly associated with the length of hospital stay (19). There are studies in the literature showing that NLR is associated with many diseases. According to the analysis of the study conducted by Alparslan et al., leukocyte, NLR and CRP values increased in proportion to the severity of the disease, on the contrary, RDW values decreased in outpatients, wards and ICU patients. Lower RDW values have been determined in severe COPD exacerbations from outpatient clinics to intensive care units (1).

Among the patients diagnosed with COPD evaluated in the Günay et al. study, it was found that the NLR values of those who presented with COPD exacerbation increased compared to stable COPD and healthy controls. However, in the same study, there was no correlation between NLR values and the severity of diseases (9).

In the study of Yao et al., it was observed that NLR and CRP levels increased in patients with AECOPD who did not survive. In this study, NLR and CRP values increased proportionally due to the severity of exacerbation from outpatient clinic to ICU (20).

Limitations in the study

Our study was conducted as a retrospective, single-centered study. It is not clear whether there is a history of blood transfusion or not, as all the data of the patients in the past are not clearly accessible. Blood transfusion is a condition that can affect the RDW value of patients. To better illustrate the impact of COPD exacerbation on RDW, we did not have a control group with similar demographics but no COPD.

Conclusion

As a result, in our study, we observed that patients with higher RDW and NLR values had longer hospital stays. This has shown that RDW and NLR measurements may be important in determining the morbidity of the disease. Since these measurements are low-cost and easily accessible, their usability in the clinic needs to be emphasized more. Of course, more comprehensive studies are needed to achieve this.

Ethical disclosures

Confidentiality of data; The authors declared that no patient data were available in this article. Right to privacy and informed consent; The authors declared that no patient data were available in this article.

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