



ORIGINAL RESEARCH PAPER

Pulmonary Medicine

RED CELL DISTRIBUTION WIDTH: A NOVEL BIOMARKER FOR HYPOXIA IN COPD

KEY WORDS: COPD, RDW, Hypoxia, severity, biomarker

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ABSTRACT

Introduction: Acute hypoxia is an important prognostic indicator in Chronic obstructive pulmonary disease (COPD) as a biomarker. RDW can aid in identification of persistent Hypoxia. Objective: To investigate the association of red cell Distribution Width (RDW) values in COPD exacerbation patients. Methods: This is a prospective cross-sectional study of 50 patients with COPD evaluated between September 2021 to December 2021. Hemogram, demographics, Spirometry and 2D echo data collected. Results: Mean age of the patients was 56 ± 10 years. Correlation between RDW with hypoxia, 6MWT, Pulmonary hypertension, CAT was found to be significant (p = 0.001 respectively) Patients with poor expiratory volumes (FEV1) were found to have higher CAT scores. Most patients in the study cohort were seen to be older, with significant smoking exposure and belonging to Stage 1 COPD. Conclusion: In conclusion, we demonstrated that elevated RDW levels in patients with COPD were associated with disease severity. It might be an indicator of hypoxemia. Therefore, an inexpensive and simple laboratory parameter, such as RDW, could be considered as a biomarker in the evaluation of the severity of COPD.

Introduction:

- Chronic obstructive pulmonary disease (COPD) is a common preventable and treatable disease characterized by persistent airway symptoms and airflow obstruction due to airway and/or alveolar abnormalities, generally due to significant exposure to harmful particles or gases and influenced by host factors including abnormal lung development. Significant co morbidities may have an impact on morbidity and mortality. (1)
- Chronic Obstructive Pulmonary Disease (COPD) is a progressively debilitating disease limiting their survival. The prevalence of COPD is expected to rise over the next 40 years and by 2060 there may be over 5.4 million deaths annually from COPD and related conditions. COPD is the one of the most important causes of death in most of the developing and developed countries. (2)
- Since acute exacerbations of COPD is reason for early readmissions has become an important outcome possible explanation for the high cardiovascular morbidity and mortality, high smoking prevalence, diet, and sedentary life style as well as systemic inflammation due to oxidative stress and chronic hypoxia. (3)
- The red cell distribution width (RDW) is a routine laboratory parameter that indicates the variability in the size of circulating erythrocytes. The main area which the RDW is used is the differential diagnosis of microcytic anemia. Increased RDW values have been reported to be related with underlying chronic inflammation which promotes red blood cell membrane deformability and changes in erythropoiesis (4)
- The systemic inflammation may be the common link between increased RDW values and hypoxia in patients with COPD. Therefore, we aimed to study the relationship between RDW and airflow limitation severity stages, Hypoxia and 6MWT in COPD patients

AIM AND OBJECTIVE: To investigate the association of red cell Distribution Width (RDW) values in COPD exacerbation patients.

STUDY DESIGN: Analytical study with a cross sectional design

PLACE OF RESEARCH: Rajarajeswari medical college and hospital, Bangalore.

STUDY PERIOD: September 2021 to December 2021

SAMPLE SIZE: 50

INCLUSION CRITERIA: aged >18 years and willing to be research subjects by signing the consent form after explanation.

EXCLUSION CRITERIA: Iron deficiency anemia, Macrocytic anemia and Anemia of chronic disease.

METHODOLOGY:

- All study subjects underwent blood tests to determine the RDW value. The RDW value comes from the measurement of the erythrocyte histogram which is expressed in the form of RDW-SD (fL unit) or RDW-CV (%). Normal RDW value is in males: 11.8 to 14.5 and in females: 12.5 to 16.1
- In addition, all study subjects underwent a spirometry examination to determine the value of the FEV1.
- 6MWT is used to measure the exertional desaturation and ABG is used to assess the hypoxia.

All study subjects were also subjected to descriptions of clinical and demographic characteristics based on gender, age, smoking history, body mass index, degree of obstruction and mMRC score.

RESULTS:

Study included a total 50 COPD patients. Mean age of the study population was 64.7±9.8 years, of whom 31 (63%) were males and 19(37%) patients were females.

TABLE: 1 GOLD STAGING DISTRIBUTION:

GOLD STAGE	NO OF PATIENTS
STAGE 1	26
STAGE 2	13
STAGE 3	09
STAGE 4	02

Characteristics of study participants

The mean smoking years of the study participants is 38.62±9.6, with FEV1/FVC ratio of 0.61±0.1, FEV1 of 69.7 ± 17.3 and with mean CAT score of 17.48 ± 7.3.

TABLE 2: CORRELATION OF RDW WITH FUNCTIONAL AND DEMOGRAPHIC PARAMETERS

Correlation variable	r	P value
Age	-0.057	0.702
Smoking Years	0.016	0.045
FEV1/FVC	0.024	0.016
FEV1	0.015	0.028
FVC	-0.195	0.184
CAT Score	0.104	0.046

TABLE 3: CORRELATION BETWEEN FEV1/FVC, FEV1 AND CAT

Parameters	CAT	
	r	P value
FeV1/FVC	-0.790	0.0001
FEV1	-0.774	0.0001

TABLE 4: COMPARISON OF RDW BY EXERTIONAL DESATURATION

RDW	Exertional desaturation		P Value
	YES	NO	
Mean	16.84	14.90	0.0001
Standard Deviation	0.99	1.78	

TABLE 5: CORRELATION BETWEEN FEV1/FVC, FEV1 AND CAT

Parameters	CAT	
	r	P value
FeV1/FVC	-0.790	0.0001
FEV1	-0.774	0.0001

TABLE 6: COMPARISON OF RDW BY HYPOXIA

RDW	hypoxia		P Value
	YES	NO	
Mean	16.96	14.47	0.0001
Standard Deviation	0.91	1.27	

FIGURE 1: COMPARISON OF RDW BY EXERTIONAL DESATURATION AND HYPOXIA

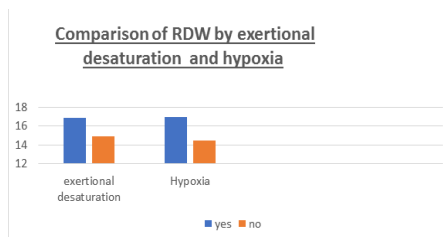
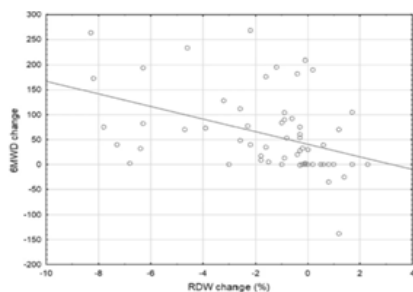


FIGURE 2 SCATTER PLOTTING SHOWING CORRELATION BETWEEN CHANGE IN 6MWD AND CHANGE IN RDW



DISCUSSION:

- Acute exacerbations of COPD are a common reason for hospital admissions and affect health-related quality of life and prognosis, and associated with an accelerated decline in lung function that is the hallmark.
- RDW reflects the coefficient of variation of the volume distribution of red blood cells. RDW is a numerical measure of the variability in the size of circulating erythrocytes and is a routine examination as a component of a complete blood count. (5)
- The inflammatory response that arises in COPD patients will lead to the production of excess pro-inflammatory cytokines so that red blood cells shorten their lifespan. According to several previous studies, there is an association between high RDW levels and increased mortality of several diseases including COPD. RDW also increases in value as the severity of COPD disease increases.
- We investigated the relationship between RDW and airflow limitation severity stages, Hypoxia in COPD patients. We found increased RDW levels associated with COPD severity and observed a higher in Hypoxic patients.
- In population of COPD patients who have experienced prolonged hypoxemia, the body will compensate by increasing erythrocyte production through stimulation of the hormone erythropoietin.
- This studies report that RDW increases with increasing degree or severity of COPD. This strengthens the hypothesis or opinion that RDW can be used as a biomarker in evaluating disease severity in patients with COPD. In patients, red blood cell counts and hemoglobin levels can also be found because the body compensates for the increased secretion of the hormone erythropoietin which stimulates the production of red blood cells. (6)
- The underlying mechanisms for the association between the RDW and mortality are currently unknown. This studies report that RDW increases with increasing degree or severity of COPD. Inflammation induces changes in erythropoiesis, erythrocyte half-life, and erythrocyte membrane deformability. (7)
- These findings suggest that the RDW% value increases with decreasing lung function, indicating the possibility of using RDW% as a biomarker not only in identifying COPD but also as a marker, to assess the severity of obstructive pulmonary disease. (8)
- Increased RDW levels might be an indicator of hypoxemia. Therefore, an inexpensive and simple laboratory parameter, such as RDW, could be considered as a biomarker in the evaluation of the severity of COPD.

CONCLUSION:

In conclusion, we demonstrated that elevated RDW levels in patients with COPD were associated with disease severity. Increased RDW levels might be an indicator of hypoxemia. Therefore, an inexpensive and simple laboratory parameter, such as RDW, could be considered as a biomarker in the evaluation of the severity of COPD.

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