

## Original Research Article

# Study of red cell distribution width levels and its correlation with severity of disease in patient with chronic obstructive pulmonary disease

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### ABSTRACT

**Background:** COPD has been accepted as component of systemic inflammatory syndrome. Red cell distribution width (RDW) is a measure of coefficient of variation of mean corpuscular volume which increases in chronic systemic inflammation. The aim of the study was to evaluate the RDW as a predictor of severity of COPD using BODE index.

**Methods:** In this cross-sectional study 107 COPD patients were evaluated by measuring RDW and this was correlated with the severity of disease using GOLD staging.

**Results:** RDW correlates well with COPD patients. Significant correlation of RDW with BODE index ( $r=0.650$ ,  $p$  and  $It; 0.001$ ), gold staging ( $r=0.459$ ,  $p$  and  $It; 0.001$ ), 6MWT ( $r=0.697$ ,  $p$  and  $It; 0.001$ ) were observed.

**Conclusions:** RDW was found to increase in patients with increasing severity of COPD. Hence its potential role as a marker of severity of disease and in predicting risk of cardiovascular disease can be explored.

**Keywords:** COPD, Red cell distribution width, GOLD staging

### INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is the leading cause of death which claimed 3 million lives in 2016. Its prevalence and consequent burden are expected to rise with rapidly increasing smoking rates in developing countries. It is estimated to be ranked as the third most common cause of death in the world by 2020.<sup>1</sup>

COPD has two components chronic bronchitis and emphysema. Chronic bronchitis is defined as the presence of chronic cough on most days for 3 months, in each of two consecutive years, in a patient whom other causes of chronic cough has been excluded.<sup>2</sup> Emphysema is defined as abnormal, permanent enlargement of distal airspaces, distal to terminal bronchioles, accompanied by destruction of their walls and without obvious fibrosis.<sup>3</sup> Currently, COPD has been accepted as component of systemic inflammatory syndrome and mortality mostly depends on

cardiovascular disease and respiratory failure. Systemic involvement due to leakage of inflammatory mediators such as cytokines, reactive oxygen species and chemokines generated in lung air spaces spill into blood stream and activate different pathways of systemic inflammatory response resulting in anisocytosis. Red cell distribution width (RDW) is the coefficient of variation of mean corpuscular volume. Initially was used to differentiate microcytic anaemia. Presently proved to be used as prognostic marker in chronic systemic inflammation. Thus, we hypothesized that RDW could be used as marker to predict the severity of pulmonary compromise in COPD patients.

### Aim

The aim of the study was (a) to evaluate red cell distribution width in chronic obstructive pulmonary disease patients; and (b) to correlate red cell distribution

width with severity of chronic obstructive pulmonary disease using GOLD staging.

**METHODS**

The cross-sectional study was conducted in the department of internal medicine, Bangalore medical college and research Institute. Total of 67 patients diagnosed to have COPD were included. The diagnosis of COPD was based on clinical criteria suggested by GOLD guideline (2017). Study conducted between January 2017 to June 2018.

**Inclusion criteria**

Patients of age more than 18 years and patients with signs and symptoms suggestive of COPD and those who are diagnosed previously by GOLD criteria were included in the study.

**Exclusion criteria**

Patients with following criteria's were included- (a) spirometry proved bronchial asthma; (b) anemia less than Hb <10 g/dl; (c) inability to perform spirometry and six minute walk test; (d) unstable angina, recent myocardial infarction left ventricular failure; (e) pregnant females; (f) clinically significant raised intra ocular pressure, urinary retention; (f) sputum positive TB or clinically proven TB; (g) connective tissue disorders, inflammatory bowel disease; (h) use of immunosuppressive drugs, systemic steroids in last 2 months; and (i) history of blood transfusion in last 6 months.

After including the patients based on inclusion and exclusion, Detailed history and thorough physical examination will be done. Dyspnoea based on MMRC grading assessed and classified accordingly. BMI was calculated and 6-minute walk test was done. RDW measurement, ECG, 2D EHO, urine routine, sputum culture and sensitivity were done.

**Statistical analysis**

Statistical analysis was performed using SPSS software. Data was analysed by descriptive statistics and RDW between various stages of patients with COPD was performed using ANOVA and Pearson correlation test. P value of less than 0.05 was considered as statistically significant.

**RESULTS**

Total number of study subjects were 107 COPD patients. Mean age in this study was 56.68 years with 15 females and 92 males included in the study (Table 1).

**COPD severity by GOLD stage**

In the study 13.1% were in grade I GOLD stage, 38.3% were in grade II GOLD stage, 30.8% were in grade III and 17.8% were in grade IV (Table 2).

**RDW-CV (co-efficient of variation) comparison with respect to GOLD staging (correlation between severity of COPD with value of RDW)**

In grade I GOLD stage, mean RDW was 15.06±1.73, in grade II GOLD stage, mean RDW was 15.75±2.33, in grade III GOLD stage, mean RDW was 17.46±2.54 and in grade IV, mean RDW was 18.47±2.16.

There was significant difference in mean RDW with respect to four grades of GOLD staging (Table 3).

$$RDW - CV = \frac{\text{Standard deviation of RBC volume}}{MCV} \times 100$$

**RDW-SD (standard deviation) comparison with respect to GOLD staging (correlation between severity of COPD with value of RDW)**

In grade I GOLD stage, mean RDW SD was 46.24±7.03, in grade II GOLD stage, mean RDW was 47.63±6.96, in grade III GOLD stage, mean RDW was 50.61±7.22 and in grade IV, mean RDW was 54.29±6.70.

There was significant difference in mean RDW-SD with respect to four grades of GOLD staging. In the study we noted as GOLD stage increases (i.e.; severity of COPD) the value of RDW also increases (RDW-CV and RDW-SD) and it is statistically significant (Table 4).

**Table 1: Gender distribution.**

Sex	Frequency	Percent (%)
Male	92	86
Female	15	14
Total	107	100

**Table 2: GOLD staging distribution among subjects.**

Gold staging	Frequency	Percent (%)
I	14	13.1
II	41	38.3
III	33	30.8
IV	19	17.8
Total	107	100.0

**Table 3: RDW-CV (co-efficient of variation) comparison with respect to GOLD staging (comparing severity of COPD with value of RDW).**

GOLD staging	RDW		P value b/w 4 grades
	Mean%	SD	
Grade I	15.06	1.73	<0.001*
Grade II	15.75	2.33	
Grade III	17.46	2.54	
Grade IV	18.47	2.16	

\*Statistically significant.

**Table 4: RDW-SD (standard deviation) comparison with respect to GOLD staging (comparing severity of COPD with value of RDW).**

GOLD staging	RDW SD		P value b/w 4 grades
	Mean	SD	
Grade I	46.24	7.03	<0.002*
Grade II	47.63	6.96	
Grade III	50.61	7.22	
Grade IV	54.29	6.70	

\*Statistically significant.

## DISCUSSION

A study by Tertemiz et al a retrospective cohort study of COPD patients, aimed to investigate the relationship of RDW with COPD severity, in this present study also we noticed positive correlation between RDW and severity of COPD.<sup>4</sup>

Seyhan et al performed retrospective analyses of 270 patients stable with COPD who were admitted in hospital between January 2007 and December 2009. In the overall patients, the RDW level had a mean value of 15.1±2.4. RDW was positively correlated with severity of COPD (GOLD stage), C-reactive protein (CRP) (p=0.008, r=0.21), right ventricular dysfunction (RVD) (p<0.001, r=0.25), and pulmonary arterial hypertension (PAH) (p=0.03, r=0.14. In this present study also, we noticed correlation.<sup>5</sup>

Sincer et al investigated the possible relationship between RDW and RV failure in patients with COPD, and searched for a possible relationship between RV function and RDW values in patients with COPD. Levels of RDW, obtained before echocardiography, were associated with the presence of RV failure, with a sensitivity of 70% and specificity of 93.1%, with a cutoff value higher than 17.7, in our study also we found correlation between RDW value and GOLD stage.<sup>6</sup>

Subhashree et al conducted a cross sectional study of 50 patients aimed at correlating the RDW% and the spirometry FEV1/FVC ratio (%) among automobile welders (cases). Further, they have analyzed the effect of smoking on the FEV1/FVC ratio% and the RDW% in the case. This study showed increases value of RDW with severity of COPD, which was similar to present study. Rahimirad et al investigated the relation of RDW to in-hospital mortality in patients with AECOPD in a retrospective study of 330 patients. In univariate analysis higher RDW-SD values were associated with increased hospital mortality (30.2% vs 15.8% p=0.002 odds ratio 2.31). Using the first quartile of RDW as reference, odds ratio (OR) mortality among patients in the highest RDW quartile was 5.34 (95% CI, 2.70-12.57; p=0.001). RDW may be a potent marker of mortality not only in stable COPD but also in AECOPD was a conclusion in the study, which is similar to our study.<sup>7</sup>

Guler et al studied RDW in patients with COPD, and to compare the value of this measurement with clinical, echocardiographic, nutritional and laboratory status. RDW values were higher in the COPD group than in controls (15±2.3% vs 13.8±2.5%, p<0.001). similar to our study, this study also showed presence of increased RDW value in severe COPD.<sup>8</sup>

Kurtoglu et al studied the relationship of RDW with smokers and healthy subjects. The mean RDW values were higher in smokers than in nonsmokers (13.9±1.2 vs 13.1±0.8, p<0.0001). Significant positive correlations between RDW and number of cigarettes smoked per day and between RDW and duration of smoking were identified (r=0.565 and r=0.305, respectively). In our study also most of the patients are smoker a smoking is the one of the important risk-factor of COPD, has more RDW value in COPD.<sup>9</sup>

Rahimirad et al investigated the relation of RDW to in-hospital mortality in patients with AECOPD in a retrospective study of 330 patients. In univariate analysis higher RDW-SD values were associated with increased hospital mortality and severity of COPD (30.2% vs 15.8% p=0.002 odds ratio 2.31), which is similar to our study.<sup>10</sup>

## CONCLUSION

Present study concludes that RDW levels are significantly elevated in COPD patients. RDW values correlated well with GOLD staging. RDW can be used as biomarker in predicting the severity of COPD.

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## REFERENCES

1. Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: Global Burden of Disease Study. *Lancet*. 1997;349(9061):1269-76.
2. Definition and classification of chronic bronchitis for clinical and epidemiological purposes. A report to the Medical Research Council by their Committee on the Aetiology of Chronic Bronchitis. *Lancet*. 1965;1(7389):775-9.
3. Snider GL, Kleinerman J, Thurlbeck WM, Bengali ZK. The definition of emphysema. Report of a National Heart, Lung, and Blood Institute, Division of Lung Diseases workshop. *Am Rev Respir Dis*. 1985;132(1):182-5.
4. Tertemiz KC, Ozgen AA, Sevinc C, Ellidokuz H, Acara AC, Cimrin A. Could "red cell distribution

- width" predict COPD severity?. *Rev Port Pneumol.* 2016;22(4):196-201.
5. Seyhan EC, Ozgul MA, Tutar N, Omur I, Uysal A, Altin S. Red blood cell distribution and survival in patients with chronic obstructive pulmonary disease. *COPD.* 2013;10(4):416-24.
  6. Sincer I, Zorlu A, Yilmaz MB, Dogan OT, Ege MR, Amioglu G, et al. Relationship between red cell distribution width and right ventricular dysfunction in patients with chronic obstructive pulmonary disease. *Heart Lung.* 2012;41(3):238-43.
  7. Subhashree AR, Shanthi B, Parameaswari PJ. The red cell distribution width as a sensitive biomarker for assessing the pulmonary function in automobile welders- a cross sectional study. *J Clin Diagn Res.* 2013;7(1):89-92.
  8. Ozgul G, Seyhan EC, Ozgul MA, Gunluoglu MZ. Red Blood Cell Distribution Width in Patients With Chronic Obstructive Pulmonary Disease and Healthy Subjects. *Arch Bronconeumol.* 2017;53(3):107-13.
  9. Kurtoglu E, Akturk E, Korkmaz H, Sincer I, Yilmaz M, Erdem K, et al. Elevated red blood cell distribution width in healthy smokers. *Turk Kardiyol Dern Ars.* 2013;41(3):199-206.
  10. Rahimirad S, Ghafari M, Ansarin K, Rashidi F, Rahimi RMH. Elevated red blood cell distribution width predicts mortality in acute exacerbation of COPD. *Pneumologia.* 2016;65(2):85-9.

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