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# Evaluation of red cell distribution width levels during acute exacerbation in patients with chronic obstructive pulmonary disease.

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## Abstract

**Aims: We aimed to observe the correlation between Red Cell Distribution Width (RDW) and acute attack of Chronic Obstructive Pulmonary Disease (COPD).**
**Methods: Patients at acute attack of COPD included to the study as study group. Control group is included subjects with stable COPD. Hemogram parameters obtained from database of the institution and analysed.**
**Results: 42 patients at acute attack of COPD and 39 subjects in stable period of COPD have been included to the study. RDW was significantly increased in patients with acute attack compared to stable COPD subjects (p<0,001).**
**Conclusion: As RDW is a simple and inexpensive inflammatory marker, increased RDW may be useful in early diagnosis of acute flares of COPD patients.**

**Keywords:** Red cell distribution width, Chronic obstructive pulmonary disease, Inflammation.

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## Introduction

Chronic obstructive pulmonary disease (COPD) is described as a preventable and treatable disease which is characterized with progressive persisting airflow limitation and increased chronic inflammatory response in airways due to harmful particles in the air. It is reported as a part of systemic inflammatory syndrome which its mortality mostly due to cardiovascular diseases instead of respiratory insufficiency [1-3]. Massive smoking, diet, sedentary lifestyle, and systemic inflammation caused by hypoxia and oxidative stress are underlying reasons of high cardiovascular morbidity and mortality rates in COPD patients [4]. RDW is a measure of routine hemogram tests which refers the size variation of erythrocytes. While it is usually normal in thalassemia trait, increased RDW is found in iron deficiency anaemia. Beside it is role in distinguishing microcytic anaemia, it is also considered as a prognostic factor in certain conditions such as, inflammatory bowel disease [5], coronary artery disease and familial Mediterranean fever [6]. Moreover, elevated RDW was considered as a result of chronic inflammatory process, which causes deformation of erythrocyte membrane. In present retrospective analysis, we aimed to observe the association between acute exacerbation of COPD and RDW levels [7-10].

## Materials and Methods

We searched the medical records of Bitlis Guroymak State Hospital Database and included patients at acute attack of COPD as study group. Control group was included subjects with stable COPD. Hemogram parameters; White blood cell count (WBC), Haemoglobin (Hb), Hematocrit (Htc), RDW, a Platelet (Plt) levels were obtained from database of the institution and analysed. All haematological assays conducted in the laboratory of our institution by auto analyser of Mindray (Mindray BC-3200, China). The original kit of the manufacturer used in assays. Data analyzed by SPSS software (IBM SPSS 16.0, Chicago, IL, USA). Definitive values were expressed as median (min-max). Continuous variables were determined whether relevant for normal distribution by Kolmogorov Smirnov test. T-test used for comparison of homogeneously distributed variables. Correlation analyse conducted by Pearson correlation test. A p value lower than 0.05 considered as statistically significant.

## Results

A total of 81 subjects; 42 patients at acute attack of COPD and 39 subjects in stable period of COPD have been included to the study 22 of patients with acute exacerbation were men and 20 of them were women. 20 of patients with stable COPD were men and 19 of them were women. Median age of the acute attack and stable COPD patients were 63 (45-86) and 65 (40-88) years, respectively. General characteristics and laboratory data of the study population were summarized in Table 1.

RDW of the patients with acute COPD exacerbation was significantly higher than that of the control group ($p<0.001$, Table 2).

We also evaluated WBC of the study population as an acute phase reactant. Patients with acute attack (11 k/mm$^3$) had

greater WBC than control subjects (7.19 K/mm3). The difference was statistically significant (p<0.001). Moreover, WBC was positively correlated with RDW in acute attack patients(r=0.244). This correlation was statistically significant (p=0.029).

***Table 1.*** *General characteristics and laboratory data of the study cohort*

| | | |
|---|---|---|
| Age (years) | Acute attack | 63 (45-86) |
| | Stable COPD | 65 (40-88) |
| Men (n) | Acute attack | 22 (% 52.3) |
| | Stable COPD | 20 (% 51.2) |
| Women (n) | Acute attack | 20 (% 47.7) |
| | Stable COPD | 19 (% 48.8) |
| Hb(gr/dL) | Acute attack | 14.6 (11.7-18.20) |
| | Stable COPD | 13.6 (6.5-10.1) |
| Htc (%) | Acute attack | 44.8 (38.7-55) |
| | Stable COPD | 41.8 (31.1-50.8) |
| WBC (K/uL) | Acute attack | 11 (4.90-19.60) |
| | Stable COPD | 7.9 (3.6-9.8) |
| Plt (K/uL) | Acute attack | 232 (106-504) |
| | Stable COPD | 249 (140-415) |
| RDW (%) | Acute attack | 15.05 (13.6-16.8) |
| | Stable COPD | 14.43 (12.5-15.9) |

***Table 2.*** *Comparison of the RDW of the study cohort*

| | RDW (%) | | | |
|---|---|---|---|---|
| | **N (%)** | **Mean** | **(Std Deviation)** | **p*** |
| ATAK | 42 (% 51.9) | 15.06 | (± 0.813) | <0.001 |
| KONTROL | 39 (% 48.1) | 14.41 | (± 0.764) | |

## Discussion

COPD is characterized with inflammation both local (airway) and systemic. Elevated RDw has been linked with inflammatory process of chronic respiratory disorders in literature [11]. Inflammation causes deterioration in the erythrocyte membrane and reduce the lifespan of red cells. RDW has been associated with conditions characterized with prominent amount of inflammation, such as, hashimoto's thyroiditis [12], rheumatoid arthritis [13], coeliac disease [14], systemic lupus erythematosus [15], and pneumonia [16]. Even diseases with mild inflammatory burden have been reported to be associated with increased RDW [17,18].

Not only inflammatory and infectious, but also malign diseases have been found to be related with an increase in RDW. Seretis et al. reported RDW as a marker of cancer activity in patients with breast cancer [17]. It has also been supposed to be a reliable marker of cancer prediction in colorectal [19-21] and brain tumors. Infections and cancers are also related with inflammation as all other diseases mentioned above. Therefore, elevated RDW is expected in COPD exacerbation. A study in literature observed RDW in different stages of COPD and reported that RDW elevation becomes more prominent as the stage of COPD advanced. Same study pointed an association between RDW and mortality in stable COPD, which we lack to show such relation in present study. We also evaluated WBC as another marker of inflammation and found significantly increased WBC in acute attack patients compared to those in stable COPD subjects. As increased WBC is a marker of acute inflammatory response, that was not a surprising result. The positive correlation between WBC and RDW in our study indicates that RDW was as valuable as WBC in predicting inflammatory burden in COPD.

What are possible mechanisms of increased RDW in inflammatory processes? Deformation of red cell membranes is a known entity in inflammation [10]. On the other hand, inflammatory molecules may interact with erythropoiesis in the bone marrow and stimulate production of red cells in variable size. As all retrospective observations, our study has some limitations. First, retrospective design could induce selection bias. Second, relatively small study cohort. These two may make our results different to interpret. However, to our knowledge, this is the first study in literature compared RDW of exacerbated and stable COPD patients. In conclusion, RDW could be a reliable marker of exacerbation in COPD, especially in subtle cases. Inexpensive and easy to assess nature may make it useful in clinical practice.

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