

Original Research Article

# Evaluation of platelet indices among patients with exacerbation of COPD in a tertiary care center in South India

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	International Archives of Integrated Medicine, Vol. 4, Issue 7, July, 2017. Copy right © 2017, IAIM, All Rights Reserved. Available online at <a href="http://iaimjournal.com/">http://iaimjournal.com/</a>
	ISSN: 2394-0026 (P)                      ISSN: 2394-0034 (O)
	Received on: 06-07-2017                      Accepted on: 12-07-2017
Source of support: Nil                      Conflict of interest: None declared.	
<b>How to cite this article:</b> Ragulan R, Viswambhar V, Krishnaveni R, Meenakshi Narasimhan, Aruna Shanmuganathan, Nisha Ganga, Gangaiamaran M. Evaluation of platelet indices among patients with exacerbation of COPD in a tertiary care center in South India. IAIM, 2017; 4(7): 161-166.	

## Abstract

**Introduction:** Mean platelet volume (MPV) and Platelet Distribution Width (PDW) is a relatively simple, inexpensive tool that indicates the platelets size, the rate of platelet production, platelet activation and the severity of inflammation since inflammation plays an important role in COPD, any alteration in platelet activity can cause alteration in MPV. Red blood cell distribution width (RDW) reflects morphology of erythrocytes whereas RDW can also vary due to systemic inflammation and ineffective erythropoiesis. Hence we aimed to study Platelet indices in patients with exacerbation of COPD.

**Aim and objectives:** Our aim is to evaluate the role of platelet Indices in COPD patients. Since only limited data were available on the relationship between COPD and platelet indices, we aimed to evaluate and find out the correlation between Mean Platelet Volume (MPV), Red Cell Distribution Width (RDW), Platelet Distribution Width (PDW) and Plateletcrit (PCT) in exacerbation of COPD patients at a tertiary care hospital in south India.

**Materials and methods:** A total of 135 subjects, 79 men and 56 women, who were admitted in our hospital with exacerbation of COPD during a period of one year were enrolled in this prospective

observational study. The levels of MPV, RDW, PDW and PCT were assessed during the course of hospital stay in patients with COPD exacerbation

**Results:** In our study we found out that there exists a statistical significance among male and female COPD exacerbation patients with respect to Mean Platelet Volume ( $P < 0.0001$ ) and Red Cell Distribution Width ( $P < 0.0001$ ). There also exists statistical significance between our COPD patients with other study stable controls ( $p < 0.005$ ). Using ROC curve, considering optimal level of MPV  $< 8.8$  fL, male population showed sensitivity of 95% and specificity of 85% with Average age in men with diagnosed COPD is 49 and average age of female COPD patient is 55.

**Conclusion:** Our study suggests that Mean Platelet Volume and Red Cell Distribution Width values may be useful for identifying patients who are at high risk for exacerbation of COPD. RDW per se is an important risk factor for Ischemic heart disease (IHD) and elevated RDW may suggest increase in risk of IHD in patients with COPD.

### Key words

Platelet indices, COPD, South India.

### Introduction

COPD is currently the fourth leading cause of death in the world, projected to be third leading cause by 2020 [1]. 3 million people died out of COPD in 2012, accounting for 6% death worldwide. COPD burden is projected to be increased in upcoming years because of increased prevalence of smoking and other COPD risk factors and aging [1]. According to GOLD 2017, Chronic Obstructive Pulmonary Disease is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and alveolar abnormalities usually caused by significant exposure to noxious particles or gases [1].

Hence early diagnosis and intervention provides betterment in prognosis. Since COPD has varied clinical presentation, assessment of it might be difficult and few cases might be missed in earlier stages. Hence, platelet indices from complete blood count were analyzed in our study.

Mean platelet volume (MPV) and platelet distribution width (PDW) is a relatively simple, inexpensive tool that indicates the platelets size and the rate of platelet production in bone marrow [2]. It indicates the platelet activation and the severity of inflammation since

inflammation plays an important role in COPD, any alteration in platelet activity can cause alteration in mean platelet volume. PCT is the volume percentage of platelets in the blood and the formula for pct is  $PCT = \text{mean platelet volume} \times \text{platelet} / 10000$  [3]. Red blood cell distribution width (RDW) reflects morphology of erythrocytes. Erythrocyte morphology changes not only by primary hematological diseases but also by systemic inflammation and ineffective erythropoiesis [4]. However role of platelet indices in COPD has not been studied in larger number and only limited studies are available showing controversial results, our study has been undertaken to assess the role of platelet indices in exacerbation of COPD patients.

### Materials and methods

A total of 135 Patients who were diagnosed with exacerbation of COPD and hospitalized in Department of Respiratory Medicine, Chettinad hospitals were taken as our study group. It was a prospective observational study and the study was approved by Ethical committee of Chettinad University and informed consent was taken from all patients.

The diagnosis of COPD was made in patients with persistent dyspnea, cough with expectoration for more than three months,

smoking history, history of biomass fuel exposure, clinical evaluation and pulmonary function test showing irreversible obstruction according to global initiative for obstructive lung disease(GOLD) guidelines.

**Inclusion criteria:** Previously diagnosed COPD patients with exacerbation who are above 40 years both male and female with progressive dyspnea, cough with mucopurulent expectoration, Fever, hypoxemia.

**Exclusion criteria** were hematological disorders, asthma, coronary artery disease, active pulmonary tuberculosis, cardiac failure, hepatic and renal failure and systemic diseases.

Clinical history was noted and blood samples were drawn from all the patients and samples sent for platelet indices analysis. Hematological parameters were determined by automated blood counter and the results were tabulated and statistical analysis was done.

### Statistical analysis

T test for equality of means with paired 2 tailed t test and one sample test was used to determine mean, standard deviation and percentage of platelet indices. Two sample independent t test using open Epi was used to find out two sided confidence interval and to study the comparison between our study group and other study control group. Receiver operation characteristic (ROC) curve analysis was conducted to identify the optimal cut-off values of MPV and RDW in exacerbation of COPD patients. A p-value < 0.05 was considered significant.

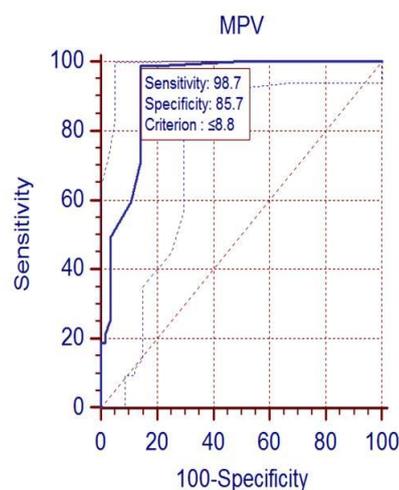
### Results

Out of 135 subjects, 79 were found to be male and 56 was found to be female. The mean and standard deviation of MPV was found to be 8.573 with SD 0.6864 with mean and SD values of RDW in male population of COPD was 16.073 and 2.073 respectively whereas in female population. It was 14.55 and 2.17. According to our study there exists a statistical significance

among male and female patients in exacerbation of COPD with respect to MPV ( $P<0.0001$ ) and RDW ( $P<0.0001$ ), we also inferred that RDW in male was found to be higher when compared to female whereas there was no significant correlation between plateletcrit and platelet distribution width in Exacerbation of COPD patients. We also found out that there exists a statistical significance between our study group COPD patients and other study control group with ( $p<0.0000017$ ) with decrease in MPV is found in exacerbation of COPD with 8.5FL compared to controlled group 9.1Fl

Receiver Operation Characteristic (ROC) predicts at the optimum level of MPV <8.8Fl, male population showed sensitivity of 98.7% and specificity of 85.7% with Area under curve for ROC (AUC) OF 0.924 WITH  $P<0.0001$ . ROC for RDW at optimum level of RDW >14.5 sensitivity was found to be 83.5 and specificity was found to be 58.9% with area under ROC curve (AUC) of 0.706 with  $p<0.0001$ . There was no statistically significant p values noted between plateletcrit and platelet distribution width (**Table – 1, 2 and Graph – 1, 2**).

**Graph - 1:** Predicts at the optimum level of <8.8Fl, there is a sensitivity of 98.7% in male population and specificity of 85.7.



Area under the curve (AUC)	0.9241
Significant p value	<0.0001

**Table - 1:** Showing comparison between our study group and other study control group showing decrease in MPV in exacerbation group (MPV-8.5) when compared to control group (MPV-9.1).

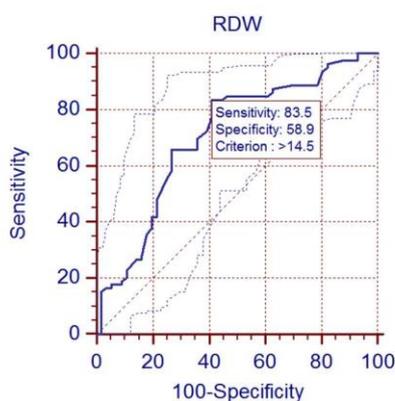
	N	Mean	Std. Deviation	P values
MPV-Subject	135	8.573	.6864	0.000
control	81	9.1	0.933	0.00000017

Two sided confidence interval 95% with significant p value of <0.00000017

**Table - 2:** showing Mean and standard deviation of RDW, PCT and PDW in Exacerbation of COPD patients with significant P values. Only the parameter RDW shows significant p value with p=0.000 and RDW in male population is comparatively higher when compared to female.

	group	N	Mean	Std. Deviation	Std. Error Mean	P values
RDW	1	79	16.073	2.0736	.2333	0.000
	0	56	14.554	2.1738	.2905	0.000
PCT	1	79	.32423	.148867	.016749	0.410
	0	56	.30545	.097090	.012974	0.377
PDW	1	79	17.319	11.4196	1.2848	0.377
	0	56	15.961	1.1369	.1519	0.297

**Graph - 2:** ROC curve Predicts at the optimum level of >14.5 there is a sensitivity of 83.5% and specificity of 58.9%.



Area under the curve (AUC)	0.706
Significant p value	<0.0001

## Discussion

The platelet indices were assessed among patients with exacerbation of COPD, which reveals that Mean platelet volume is decreased during exacerbation of COPD when compared to stable controls and Red cell distribution width is increased in COPD exacerbation patients. Also we found out that RDW in male population is found to be higher than the female population.

Our study hence suggest that Mean platelet volume can be used as an inflammatory biomarker in COPD whereas Red cell distribution width could be used as a positive predictor for occurrence of coronary artery disease in COPD patients. Tertemiz KC, et al. [4] revealed that as RDW increases with severity in COPD also increases, that might be due to variation in size of circulating erythrocytes. However, the above study didn't find out the optimal value for RDW as in our study and sample size was comparatively lesser. Tadeusz Osadnik, et al. [5] suggested that RDW is an independent predictor of mortality in patients with stable coronary artery disease Yavsan, et al. [6] suggested that decrease in RDW can cause non-invasive ventilation failure in COPD patients. According to Wang, et al. [7] suggested that MPV is significantly reduced during exacerbation when compared to controls in accordance with our study, whereas they also found increase in CRP, fibrinogen and WBC levels in exacerbation of COPD patients.

Gulistan Karadeniz, et al. [8] suggested that MPV is decreased during exacerbation of COPD

whereas increase in PDW was found, which was converse to our study, where PDW was found to be normal. Paschalis Steiropoulos, et al. [9] suggested that MPV in smokers with COPD is significantly higher when compared to smokers with no airflow obstruction which is in converse to our study. Ulasli, et al. [10] revealed that MPV in acute exacerbation is low while compared to normal controls.

Bansal, et al. [11] revealed that mean platelet volume was increased in COPD patients when compared to controls (converse to our study) study also suggested that COPD patients with increase MPV predisposes to pulmonary thromboembolism and pulmonary hypertension, where the drawback of study being comparison of single platelet indices leaving out the other three, which was done in our study. Zalawadiya SK, et al. [12] suggested that higher RDW appears to be a powerful independent predictor of future CHD risk. However number of studies have demonstrated that subjects with COPD have an increased platelet count and also increased platelet activation in stable disease and further in the exacerbation period [13]. Platelet activation can cause both increase and decrease in mean platelet volume. Low mean platelet volume [2] can also be found in aplastic anemia, wiskot Aldrich syndrome, rheumatoid arthritis, inflammatory bowel disease, and familial Mediterranean fever, whereas sequestration of large activated platelets can also cause decrease in MPV. Increased mean platelet volume is found in thrombosis, such as cardiovascular disease or atherosclerosis [2], Increase in RDW is also found in Iron Deficiency Anemia, folate and vitamin B12 deficiency, Hemolytic Anemias. Hence it is very much necessary to exclude the other causes of decrease in MPV or increase in RDW to interpret the significance of the same in COPD [14].

### **Conclusion**

Our study suggests that Mean Platelet Volume and Red Cell Distribution Width are relatively a simple, inexpensive, non invasive, sensitive test,

that might be useful in identifying patients who are at high risk for exacerbation of COPD. High Red cell distribution width could be used as a predictor in assessing severity of COPD. Increased RDW per se is an important risk factor for IHD, elevated RDW suggest increase in risk of IHD in patients with COPD. A low mean platelet volume indicates exacerbation of COPD whereas negative correlation occurs between MPV and severity of COPD.

### **Limitations**

Limited sample size. More study population should be included. The severity grading of COPD is not taken in our study. Other components of COPD and their correlation with COPD should be studied. However, further studies are needed to evaluate the platelet and CBC indices with larger sample size and to assess if early monitoring of MPV and other platelet indices can reduce the exacerbation of COPD and improves quality of life. And whether increase in Red cell distribution width can predict and if diagnosed earlier, the occurrence of IHD and cardiac abnormalities in COPD patients can be prevented should also be studied.

### **References**

1. Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. Updated 2017. [http://www.goldcopd.org/uploads/users/files/GOLD\\_Report\\_2017\\_Feb18.pdf](http://www.goldcopd.org/uploads/users/files/GOLD_Report_2017_Feb18.pdf).
2. Agapakis I, Massa V, Hantzis, Maraslis, Alexiou, Imprialos P, et al. The Role of Mean Platelet Volume in Chronic Obstructive Pulmonary Disease Exacerbation. *Respir Care*, 2016; 61(1): 44-49.
3. Yasemin Ustundag Budak, Murat Polat, Kagan Huysal. The use of platelet indices, plateletcrit, mean platelet

- volume and platelet distribution width in emergency non-traumatic abdominal surgery: a systematic review. *Biochem Med (Zagreb)*, 2016; 26(2): 178–193.
4. Tertemiz KC, Ozgen Alpaydin A, Sevinc, Ellidokuz, Acara AC, Cimrin, et al. Could "red cell distribution width" predict COPD severity. *epub* 2016 Jul-Aug; 22(4): 196-201.
  5. Tadeusz Osadnik, Joanna Strzelczyk, Michał Hawranek, Andrzej Lekston, Jarosław Wasilewski, Anna Kurek, et al. Red cell distribution width is associated with long-term prognosis in patients with stable coronary artery disease. *BMC Cardiovascular Disorders*, 2013; 13(12): 113.
  6. Mehmet Yavsan, Mustafa Goktepe, Mustafa Tosun, Emine Karata, Turgut Tekeand Kursat Uzun, et al. Red cell distribution width and mean platelet volume as a non-invasive ventilation success marker in COPD with acute hypercapnic respiratory failure. *European Respiratory Journal*, 2014; 44(12).
  7. Wang RT, Li JY, Cao ZG, Li Y. Mean platelet volume is decreased during an acute exacerbation of chronic obstructive pulmonary disease. *Respirology*, 2013; 18(8): 1244-1248.
  8. Gülistan Karadeniz, Serir Aktogu, Onur Fevzi Erer, Serpil Bulaç Kir, Sibel Doruk, Melike Emir, et al. Evaluation of mean platelet volume and platelet distribution width in patients with chronic obstructive pulmonary disease. *European Respiratory Journal*, 2015; 46(11).
  9. Paschalis Steiropoulos, Evangelia Nena, Maria Xanthoudaki, Pavlos Zarogoulidis, Thomais Goula, Panagiotis Boglou, et al. Mean platelet volume and platelet distribution width in patients with chronic obstructive pulmonary disease. *J thorac dis.*, 2012; 4(11).
  10. Ulasli SS, Ozyurek BA, Yilmaz EB, Ulubay G. Mean platelet volume as an inflammatory marker in acute exacerbation of chronic obstructive pulmonary disease. *Pol Arch Med Wewn*, 2012; 122(6): 284-290.
  11. Rajeev Bansal, Hem Lata Gupta, Atul Goel, Madhur Yadav, et al. Association of Increased Platelet Volume In Patients of Chronic Obstructive Pulmonary Disease: Clinical Implication. *JACM*, 2002; 3(2): 169-72.
  12. Zalawadiya SK, Veeranna V, Niraj A, Pradham J, Afonso L. Red cell distribution width and risk of coronary heart disease events. *Am J cardiol.*, 2010; 106(7): 988-93.
  13. Biljak VR, Pancirov D, Cepelak I, Popovic-Grle S, Stjepanovic G, Grubisic TZ. Platelet count, mean platelet volume and smoking status in stable chronic obstructive pulmonary disease. *Platelets*, 2011; 22(6): 466-470.
  14. Maclay JD, McAllister DA, Johnston S, Raftis J, McGuinness C, Deans A, et al. Increased platelet activation in patients with stable and acute exacerbation of COPD. *Thorax*, 2011; 66(9): 769-774.