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A Study of Platelet Parameters as a Novel Marker of Severity of Inflammation in Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is one of the leading causes of death worldwide, characterised by both systemic as well as pulmonary inflammation. During an acute exacerbation, the inflammatory pathways are unregulated to a greater extent and may also precipitate a critical cardiovascular event. Platelet parameters like platelet count, Mean platelet volume (MPV) and platelet distribution width (PDW) are markers of platelet activation and also has been associated with various inflammatory conditions.

Aim of the Study: To find out the role of Platelet Parameters in COPD and to establish the relationship between the severity of COPD with the Platelet Parameters and to find out whether the platelet parameters can be a useful prognostic tool that will help the therapeutic target in COPD.

Material and Methods: Forty COPD patients who visited Pulmonary Medicine OPD during the study period, were included in the study. COPD patients were diagnosed by spirometry and classified according to the GOLD's criteria.The results of the Spirometry was compared with the different platelet parameters like platelet count, mean platelet volume and platelet distribution width to establish the probable role of platelets in the severity of COPD.

Result and Conclusion: It was concluded from the study that as the disease worsens, the number of platelets increase and this result is associated with spirometric parameters. The MPV and PDW also increased with the severity of disease in patients with COPD.So, the platelet parameters can be used as a simple, quick, tool to predict the severity in COPD patient and help in predicting the prognosis of the disease.

Key Words: COPD, Spirometry, Platelet parameters, MPV, PDW

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is estimated to affect greater than 5% of the adults and with a progressively rising rate of morbidity and mortality[1,2]. As it is estimated, COPD will be the third leading cause of death worldwide by 2020[3,4]. COPD is a great financial burden upon health systems, primarily because of its acute exacerbations which require hospitalization[5]. COPD is mainly characterized by restricted airflow, which is a result of inflammation as well as the remodelling of the airways[6]. COPD is characterised by both systemic as well as pulmonary inflammation. During an acute exacerbation, the inflammatory pathways areunregulated to a greater extentand may also precipitate acute cardiovascular events.COPD is also associated with low-grade systemic inflammation as obvious from increased total leucocyte count, acutephase proteins like C-reactive protein (CRP), and inflammatory

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cytokines[7]. Platelet parameters like platelet count, Mean platelet volume (MPV) and platelet distribution width (PDW)[8] are markers of platelet activation.[9-11] Increased MPV is associated with many vascular diseases,like peripheral, cerebrovascular disease, and coronary artery disease[12,13]. Biljak *et al*[14] reported elevated platelet count and decreased MPV in COPD patients. In contrast, Cui *et al*[15] stated that a high MPV predicts impaired pulmonary and cardiac function in elderly COPD patients. However, only a few studies have been done showing the relationship between MPV and the severity of COPD. Hence our study aimed to establish the role of platelet parameters in patients of COPD and to find the co-relationof various platelet parameters with the severity of COPD. We also intended to find out if itcould be used as a prognostic tool in future.

AIMS AND OBJECTIVES

1. The study aimed to find out the role of Platelet Parameters in COPD and toestablish the relationship between the severity of COPD with the Platelet Parameters.
2. To find out whether the platelet parameters can be a useful prognostic tool that willhelp the therapeutic target in COPD.

MATERIAL AND METHODS

The study was undertaken in the Department of Physiology of IMS and SUM Hospital, Bhubaneswar. Forty COPD patients who visited the Pulmonary Medicine OPD during the study period were included in the study. COPDpatients were diagnosed according to the GOLD's criteria. Approval from the institutional ethic committee (IEC) was obtained, and written informed consent was taken from patients who participated in the study. Patients withother acute and chronic lung diseases, Haematological disorders, patients with any other chronic inflammatory condition or Cancer patients on Long term Oxygen Therapy were excluded from the study.

In all the patients included in the study group, the following investigations were done in addition to the routine investigations:

- platelet count, mean platelet volume and platelet distribution width.
- Pulmonary Function Tests
- Chest X-Ray

The result of various tests wasrecorded independently of one another. A detail medical history was obtained,and a detail physical examination was performed. Physical examination was followed by spirometry.

COPD was diagnosed on the basis of clinical examination (chronic and progressive dyspnea, cough, and sputum production) and also spirometry findings (FEV1/ FVC (forced vital capacity) <0.70 after use of bronchodilation).

The Spirometry results (Lung Function Test) was used to define the severity of disease as per the Global Initiative for Chronic Obstructive Lung Disease classification(GOLD criteria).

stage I (mild)-GOLD 1- FEV1/FVC<70% and FEV1≥80% predicted;

stage II (moderate)-GOLD 2- FEV1/FVC<70% and 50%≤FEV1<80% predicted;

stage III (severe)-GOLD 3- FEV1/FVC<70% and 30%≤FEV1<50% predicted;

stage IV (very severe)-GOLD 4- FEV1/FEVC<70% and FFEV1<30% predicted.'

For our study, the first three categories were taken into consideration.

Biochemical Analysis of Blood Samples

The blood sample was collected in the morning following an overnight fast. Ethylenediaminetetraaceticacid tubes were used to avoid platelet swelling, MPV and PDW was estimatedwithin 30minutes after sampling by an automated blood cell counter (Sysmex XE 2100, Kobe, Japan). The results of the Spirometry was compared with the different platelet parameters likeplatelet count, mean platelet volume and platelet distribution width to establish the probablerole of platelets in the severity of COPD.

Statistical Analysis

The statistical analysis was done using SPSS 20. The quantitative data were summarized with Mean ± standard deviation and documented. Correlation between ages ofdifferent groups such as mild, moderate and severe was calculated using chi-square test, and the difference in the proportion of cases with varying levels of MPV in both groups and the variousother clinical parameters like FVC, FEV1, FEV1/ FVC, PDW and platelet count were analysed using ANOVA.

RESULTS

A total of 40 Chronic Obstructive Pulmonary Disease were studied for platelet parametersand pulmonary function test. After analysis, the following results were obtained. All test results were significant at P<0.05, and p<0.001 was considered highly significant. In our study, we found a significant increase in MPV, PDW and platelet count with an increase in the severity of COPD.

OBSERVATION

Table 1: Demographic characteristics of COPD patients

Variables	Study group (COPD Patients)	Mild COPD Stage I (mean ± SD)	Moderate COPD stage II (mean ±SD)	Severe COPD Stage III (mean ± SD)	P-value
Number	40	10	20	10	
Age in years	44±9.8	39.0±18.39	46.95±15.61	47.0±13.61	P<0.3
Sex (male/female)	23/17	5/5	11/9	7/3	P< 0.7

Table 2: Spirometric findings of different study groups

Variables	MildCOPDStage I (mean±SD)	ModerateCOPD stage II(mean±SD)	SevereCOPDStage III(mean±SD)	P-value
FEV1 (% predicted)	84.40±7.39	62.72±9.15	37.96±4.83	P<0.001
FVC (%predicted)	99.00±20.90	72.48±14.28	47.94±6.03	P<0.001
FEV1/FVC (%) (mean±SD)	65.48±3.09	66.11±5.68	64.15±3.53	P<0.563

Table 3: Platelet Parameters in different study groups

Variables	MildCOPD (mean±SD)	ModerateCOPD (mean±SD)	SevereCOPD (mean±SD)	P-value
Plateletcount ($x10^9$/litre)	267.4±32.38	342.9±68.26	484.8±19.54	P<0.001
Mean platelet volume (MPV) in fl	8.46±0.23	9.19±0.12	9.82±0.15	P<0.001
Platelet Distribution Width (PDW) in %	11.18±0.44	12.81±0.21	13.89±0.31	P<0.001

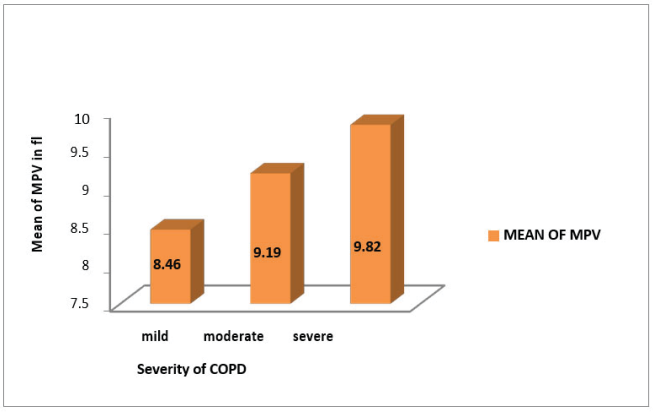

Figure 1: Mean Platelet Volume in the study groups.

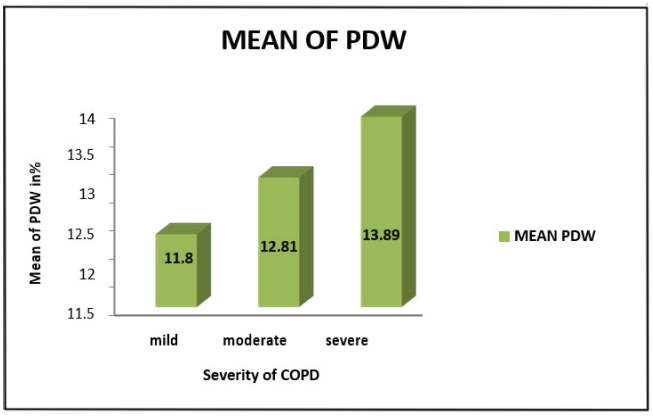

Figure 2: Mean Platelet Distribution Width in the study groups.

DISCUSSION

COPD is a progressive disease along with chronic inflammation. It presents with an acute increase in severity of the disease, which may be due to several factors like air pollution, occupational exposure, age and genetic susceptibility. Stable COPD is associated with low-grade systemic inflammation whichcan be concluded from increasinglevels of blood leucocytes and acute phase proteins[15,16]. As indicated from earlier studies, it is suggestive that the lung function impairment in COPD is strongly associated with impaired cardiovascular functions and deaths related to the cardiovascular system[17]. In addition to it, COPD and atherosclerosis frequentlycoexist and have some combined risk factors like age and also smoking. Inflammation is considered as the leading cause of progression of COPD and atherosclerosis. Platelets are considered to be responsible for atherogenesis, atherothrombosis and inflammation. According to recent studies, it has been found that an increase inarginase activity in case of platelets indicates altered metabolism of Nitric oxide and an increase in platelet activity seen in COPD[18]. It was also reported that patients of COPD had higher level of soluble P Selectin, a marker of platelet hyperreactivity[19]. Somestudies indicate the inverse relations between MPV and disease activity in rheumatoid arthritis, inflammatorybowel disease, and ankylosing spondylitis[20,21]. MPV is referred to asa 'marker of inflammation', is found to be elevated in patients who are at risk of atherothrombotic disease. MPV and PDW reflect the platelets sizeand the rate of production ofplatelets in the bone marrow, and it can be used as an indicator of activation of plateletand the severity of inflammation.

In our study, we have found that the platelet countincreases significantly as the severity of COPD increases. There was also a significant increase in MPV and PDW with increasing severity of the disease. However, the association between Mean platelet Volume and COPD is still unclear. Some studies have shown that patients with Stable COPD have an increased level of MPV compared to those in the control groups[22] whereas according to another report it was found that this association of increased mean platelet volume in COPD patients was not significant statistically [(23)].The controversial statements may bea result of the inability to rule out confoundingfactors like body mass index, use of specific medication, Obesity, smoking statusetc[21]. Onder *et al* [24] studied the relationship between hypoxia and thrombocytes in patients of COPD, and they concluded that MPV values were higherin hypoxic patients with COPD as compared tonon-hypoxic participants and controls. Biljak *et al*. [(14)] found that patients with stable COPD patients had a significantlyhigher level of PLT count and decreased MPV in comparison to healthy controls.

CONCLUSION

In this study, the role of Platelet Parameters as an inflammatory marker of COPD was tried to beestablished. We tried to find out the diagnostic efficacy of the Platelet parameters in determining the mode of treatment to prevent further complication in patients with COPD. We found that as there is worsening of the disease, the number of platelets increases. The MPV and PDW also increased with the severity of illness in patients with COPD. So, the platelet parameters can be used as a simple, quick, tool to predict the severity in COPD patient and thereby help to determine the prognosis and plan for treatment.The sample size was kept less in the study, andin future, more extensiveresearch can be conducted taking a large sample size.

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REFERENCES

1. Coultas DB, Mapel D, Gagnon R, Lydick E. The health impact of undiagnosed airflowobstruction in a national sample of United States adults. Am J Respir Crit Care Med.2001;164(3):372–377.
2. Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global burden of disease study. Lancet. 1997;349(9064):1498–1504.
3. Michaud CM, Murray CJ, Bloom BR. Burden of diseaseimplications for futureresearch. JAMA. 2001;285(5):535–539.
4. Sullivan SD, Ramsey SD, Lee TA. The economic burden of COPD. Chest. 2000;117(suppl):5S-9S.
5. Geitona M, Hatzikou M, Steiropoulos P, Alexopoulos EC, Bouros D. The cost of COPD exacerbations: a university hospital-based study in Greece. Respir Med. 2011;105(3):402–409
6. Global Strategy for the Diagnosis, Management and Prevention of COPD, GlobalInitiative for Chronic Obstructive Lung Disease (GOLD). Definition: Chapter 1. 2010.pp. 1–7.
7. Vernooy H, Küçükaycan M, Jacobs A. Local and systemic inflammation in patientswith chronic obstructive pulmonary disease: soluble tumor necrosis factor receptors are increased in sputum. Am J Respir Crit Care Med 2002; 166:1218–1224.
8. Vagdatli E, Gounari E, Lazaridou E, Katsibourlia E, Tsikopoulou F, LabrianouI. Platelet distribution width: a simple, practical and specific marker of activation of coagulation. Hippokratia. 2010; 14(1):28–32.

9. Tsiara S, Elisaf M, Jagroop IA, Mikhailidis DP. Platelets as predictors of vascular risk:is there a practical index of platelet activity? Clin ApplThromb Hemost.2003;9(3):177–190.
10. Jagroop IA, Clatworthy I, Lewin J, Mikhailidis DP. Shape change in human platelets: measurement with a channelyzer and visualisation by electron microscopy. Platelets.2000; 11(1):28–32.
11. Park Y, Schoene N, Harris W. Mean platelet volume as an indicator of plateletactivation: methodological issues. Platelets. 2002; 13(5-6):301–306.
12. Gasparyan AY, Ayvazyan L, Mikhailidis DP, Kitas GD. Mean platelet volume: a linkbetween thrombosis and inflammation? Curr Pharm Des. 2011;17(1):47–58.
13. Vizioli L, Muscari S, Muscari A. The relationship of mean platelet volume with therisk and prognosis of cardiovascular diseases. Int J Clin Pract. 2009;63(10):1509–1515.
14. Biljak *et al*. Platelet count, mean platelet volume and smoking status in stable chronic obstructivepulmonary disease. Platelets. 2011;22(6):466–470.
15. Sandhaus L, Meyer P. How useful are CBC and reticulocyte reports to clinicians? Am J Clin Pathol 2002; 118:787–793.
16. Dev D, Wallace E, Sankaran R, *et al,* Value of C-reactive protein mea-surements in exacerbations of chronic obstructive pulmonary disease. Respir Med. 1998; 92: 664–667.
17. Schols AM, Buurman WA, Staal van den Brekel AJ, *et al,* Evidence for a relationbetween metabolic derangements and increased levels of inflammatory mediators in asubgroup of patients with chronic obstructive pulmonary disease. Thorax.1996; 51:819–824.
18. Sin DD, Wu L, Man SF. The relationship between reduced lung function andcardiovascular mortality: a population-based study and a systematic review of theliterature. Chest 2005; 127: 1952–9.
19. Guzman-Grenfell A, Nieto-Velazquez N, Torres-Ramos Y *et al*., Increased platelet anderythrocyte arginase activity in chronic obstructive pulmonary disease associated withtobacco or wood smoke exposure. J. Investig. Med. 2011; 59: 587–92.
20. Ferroni P, Basili S, Martini F *et al*, Soluble P-selectin as a marker of platelet hyperactivity in patients with chronic obstructive pulmonary disease. J. Investig. Med.2000; 48: 21–27.
21. Varol E, Icli A, Kocyigit S *et al*, Effect of smoking cessation on mean platelet volume.Clin. Appl. Thromb. Hemost.2012; 19: 315–9.
22. Yarlioglues M, Ardic I, Dogdu O *et al*, The acute effects of passive smoking on meanplatelet volume in healthy volunteers. Angiology 2011; 63: 353–357.
23. Ulasli SS, Ozyurek BA, Yilmaz EB *et al*, Mean platelet volume as an inflammatorymarker in acute exacerbation of chronic obstructive pulmonary disease. Pol. Arch. Med. Wewn. 2012; 122: 284–290.
24. Onder I, Topcu S, Dokmetas HS., Platelet aggregation size and volume in chronicobstructive pulmonary disease. Mater Med Pol 1997; 29:11–13.