International Journal of Advances in Medicine
Biradar S et al. Int J Adv Med. 2021 Oct;8(10):1530-1535
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: https://dx.doi.org/10.18203/2349-3933.ijam20213639

Original Research Article

Eosinopenia as a marker of outcome in acute exacerbation of chronic obstructive pulmonary disease

Sneha Biradar*, Balakrishna Teli, Prashanth V. N.

Department of Medicine, Bangalore Medical College and Research Institute, Bangalore, Karnataka, India

Received: 04 August 2021
Revised: 23 August 2021
Accepted: 23 August 2021

***Correspondence:**
Dr. Sneha Biradar,
E-mail: biradar.sneha83@gmail.com

ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD), the fourth leading cause of death in the world. Acute exacerbation of COPD has 10% mortality rate at admission and 1/3rd die within a year of hospitalization. Eosinopenia typically accompanies the response to acute inflammation or infection. The objective of this study was to know whether eosinopenia is an economical marker in predicting the outcome in patients hospitalized due to acute exacerbation of COPD.

Methods: This is a prospective study conducted on 121 patients presenting with AECOPD satisfying inclusion and exclusion criteria admitted in hospitals attached to Bangalore Medical College and Research Institute. All necessary investigations were done. Patients with AECOPD were divided in two groups: One with eosinopenia and other without eosinopenia. Duration of hospitalization, need for mechanical ventilation and in-hospital mortality was assessed in both the groups.

Results: Among 121 patients with AECOPD, 56 were eosinopenic and 65 patients were non-eosinopenic. Majority of patients belonged to age group of 51-60 years with mean age was 62.06±10.783 years. Duration of hospitalization of patients with eosinopenia was 9.04±5.18 days and that of patients without eosinopenia was 6.15±2.89 (p value<0.001). Among them, 41 (73.2%) patients with eosinopenia and 21 (32.3%) patients without eosinopenia needed mechanical ventilation (p≤0.001). In-hospital mortality rates among eosinopenic and non-eosinopenic patients were 53.6% and 15.4% respectively.

Conclusions: There is a significant relationship between eosinopenia and outcomes of patients with AECOPD. Thus, eosinopenia is a useful, easy-to-measure, inexpensive biomarker for predicting the prognosis and outcome in patients with AECOPD.

Keywords: AECOPD, Eosinopenia, Mechanical ventilation, Mortality

INTRODUCTION

COPD is a preventable and treatable disease state characterized by persistent respiratory symptoms and airflow limitation that is not fully reversible. There is progressive airflow limitation which is associated with an abnormal inflammatory response of the lungs to noxious particles or gases.[1] COPD is now rising to be the 3rd leading cause of death in the world by 2020.This is because of increased smoking and ageing of the world population and also because of reduced mortality from other causes such as cardiovascular disease.[1] The Burden of obstructive lung disease (BOLD) initiative estimates a worldwide population prevalence of COPD for stages II or higher as equivalent to 10.1±4.8% overall with 11.8±7.9% for men and 8.5±5.8% for women.[2] In India prevalence of COPD is around 5% among males and 2.7% among females, with a male to female ratio of 1.85:1.5.[3] Eosinopenia defined as

eosinophil count <40 cells/mm^3. Eosinopenia typically accompanies the response to acute inflammation or infection. Abrupt eosinopenia may be the result of release of small amounts of the chemotactic factors of acute inflammation into the circulation. Sequestration could be ascribed to migration of eosinophils to the inflammatory site itself, by the chemotactic substances released at time of acute inflammation.[2]

Eosinophil plays an important role in pathogenesis of asthma, allergic disorders, parasitic diseases, and hypereosinophilic syndromes. More recently eosinophils are identified to have immunomodulatory roles in innate host defense, adaptive immunity, tissue repair or remodeling, and maintenance of normal tissue homeostasis. In asthma eosinophils play a major role in pathophysiology including airway epithelial damage and airway remodeling including smooth muscle hyperplasia and subepithelial fibrosis.[4]

The aim of the study was to know whether eosinopenia is an economical marker in predicting the outcome in patients hospitalized due to acute exacerbation of COPD.

METHODS

The Prospective cohort study was conducted on 121 patients presenting with acute exacerbation of COPD satisfying inclusion and exclusion criteria admitted in hospitals which are attached to Bangalore Medical College and Research Institute during the study period of November 2017-May 2019.The random sampling was done.

Inclusion criteria

Patients with following criteria were included- (a) age >18 years; (b) *p*atients willing to give written informed consent; and (c) patients diagnosed as COPD presenting with exacerbation according to GOLD's criteria.

Exclusion criteria

Patients with following criteria were excluded- (a) use of systemic steroids in last 30 days; (b) case of bronchial asthma and COPD overlap, allergic conditions; and (c) conditions with documented eosinophilia.

Statistical analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Chi square test was used as test of significance for qualitative data.

Continuous data was represented as mean and SD. Independent t test was used as test of significance to identify the mean.

Statistical analysis

MS excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

RESULTS

A total of 132 patients were recruited for the study. Among them 11 patients did not meet the inclusion criteria and few were on steroid treatment. After exclusion, 121 patients were included in the study. In our study majority of patients belonged to rural population (62%) and rest to the urban population (38%). According to CDC's Morbitiy and mortality weekly report (MMWR), percentage of adults diagnosed with COPD in rural areas (8%) was double the percentage in large metropolitan areas (5%).[5]

In eosinopenia group, 83.9% were males and 16.1% were females and in non-eosinopenia group, 75.4% were males and 24.6% were females. There was no significant difference in sex distribution between two groups

In the study based on AEC, 46.3% had eosinopenia and 53.7% had no eosinopenia. In the study there was no significant difference in CBC profile, urea, LFT and serum electrolyte between eosinopenia and non-eosinopenia subjects.

Mean serum creatinine among those with eosinopenia was 1.122±0.90 and among those with non-eosinopenia was 0.812±0.38. There was significant difference in mean creatinine between two groups. In the study there was significant difference in mean FEV1 and FEV1/FVC between two groups. Subjects with eosinopenia had lower FEV1 and FEV1/FVC ratio compared to those with non-eosinopenia.

Outcome

In the study mean duration of hospital stay among eosinopenia subjects was 9.04±5.18 and among non-eosinopenia group was 6.15±2.89. There was significant difference in mean duration of stay between two groups.

In the study among eosinopenia subjects, 73.2% were on mechanical ventilation and among non-eosinopenia subjects, 32.3% were on mechanical ventilation. There was significant difference in mechanical ventilation between two groups. In the study among eosinopenia subjects, 53.6% had mortality and among non-eosinopenia subjects, 15.4% had mortality. There was significant difference in mortality between two groups.

Mean AEC among those who were alive was 103.94±84.535 and among who died was 48.95±59.022. There was significant difference in mean AEC between those who died and alive subjects. AEC at cut off of ≤40, sensitivity was 75%, specificity was 67.9%, PPV was 53.6% and NPV was 84.6%.

Table 1: Laboratory profile distribution and comparison between eosniopenia and non-eosinopenia group.

Parameters		AEC						P value
		Eosinopenia		Non-eosinopenia		Total		
		Mean	SD	Mean	Mean	SD	Mean	
CBC	HB	12.91	2.82	13.54	2.25	13.25	2.54	0.175
	TLC	11739.48	5098.56	10969.63	4586.04	11383.19	4863.36	0.388
	Neutrophil	79.02	13.82	76.37	13.79	77.59	13.81	0.294
	Lymphocytes	16.81	12.19	16.07	10.15	16.41	11.10	0.715
	Eosinophils	1.34	2.30	1.52	2.30	1.44	2.29	0.661
	Monocytes	3.38	3.14	3.49	3.27	3.44	3.20	0.844
	Platelet	2.27	1.28	2.65	.98	2.47	1.14	0.063
Renal profile	Urea	47.78	39.31	36.83	23.41	41.90	32.10	0.061
	Creatinine	1.122	0.90	0.812	0.38	0.96	0.69	0.013*
LFT	TB	0.67	0.68	0.59	0.52	0.63	0.60	0.453
	DB	0.31	0.34	0.23	0.29	0.27	0.31	0.181
	SGOT	144.73	541.88	34.50	49.02	85.51	372.71	0.105
	SGPT	122.00	424.67	29.55	24.21	72.34	291.74	0.082
	ALP	94.95	58.58	94.14	47.90	94.51	52.89	0.934
	ALB	3.53	0.92	3.49	0.55	3.51	0.74	0.790
	TP	6.35	0.73	6.36	0.85	6.36	0.79	0.982
Serum electrolyte	Na	132.89	7.39	134.66	4.52	133.84	6.06	0.110
	K	3.77	0.90	4.03	0.69	3.91	0.80	0.075

Note: *statistically significant p value.

Table 2: Pulmonary function test distribution and comparison between eosinopenia and non-eosinopenia group.

Parameters	AEC						P value
	Eosinopenia		Non-eosinopenia		Total		
	Mean	SD	Mean	Mean	SD	Mean	
FEV1	66.22	16.98	73.86	15.34	70.63	16.42	0.018*
FEV1/FVC	0.36	0.24	0.46	0.24	0.42	0.25	0.019*

Note: *statistically significant p value.

Table 3: Duration of hospital stay distribution and comparison between eosinopenia and non eosinopenia group.

Parameters	AEC						P value
	Eosinopenia		Non-eosinopenia		Total		
	Mean	SD	Mean	Mean	SD	Mean	
Duration of stay	9.04	5.187	6.15	2.895	7.44	4.30	<0.001*

Note: *statistically significant p value.

Table 4: Mechanical ventilation distribution and comparison between eosinopenia and non-eosinopenia group.

Parameters		AEC						P value
		Eosinopenia		Non-eosinopenia		Total		
		Count	%	Count	%	Count	%	
Mechanical ventilation	No	15	26.8	44	67.7	59	48.8	<0.001
	Yes	41	73.2	21	32.3	62	51.2	

Note: χ^2 =20.148, df =1, p<0.001*

Table 5: Mortality distribution and comparison between eosinopenia and non-eosinopenia group.

Parameters		AEC						P value
		Eosinopenia		Non-eosinopenia		Total		
		Count	%	Count	%	Count	%	
Mprtality	No	26	46.4	55	84.6	81	66.9	<0.001

Continued.

Parameters		AEC						P value
		Eosinopenia		Non-eosinopenia		Total		
		Count	%	Count	%	Count	%	
	Yes	30	53.6	10	15.4	40	33.1	

Note: χ^2 =20.148, df =1, p<0.001*

Table 6: AEC comparison with respect to subjects who died and alive.

Group statistics	Mortality	N	Mean	SD	Median	P value
AEC	Alive	81	103.94	84.535	100.00	<0.001*
	Died	40	48.95	59.022	30.00	

Table 7: Validity of AEC in predicting mortality- Area under the ROC curve (AUC).

Area under the ROC curve (AUC)	0.776
Standard error	0.0469
95% Confidence interval	0.691 to 0.847
Z statistic	5.887
Significance level P (area=0.5)	<0.0001

Table 8: Validity of AEC in predicting mortality- Youden index.

Youden index J	0.4290
Associated criterion	≤40

Table 9: Validity of AEC in predicting mortality- criterion values and coordinates of the ROC curve.

Criterion	Sensitivity	95% CI	Specificity	95% CI	+LR	-LR	+PV	-PV
≤40	75.00	58.8-87.3	67.90	56.6-77.8	2.34	0.37	53.6	84.6

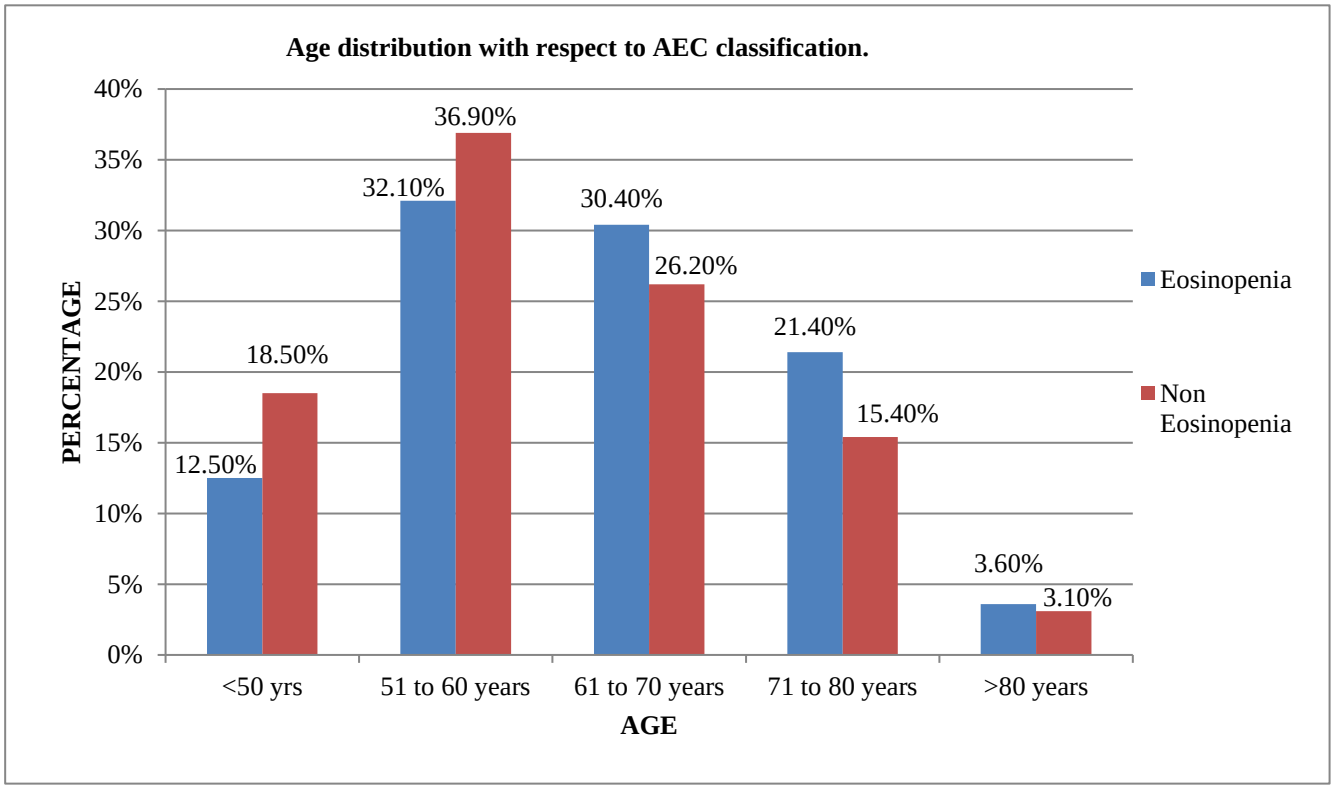

Figure 1: Age distribution with respect to AEC classification in study subjects.

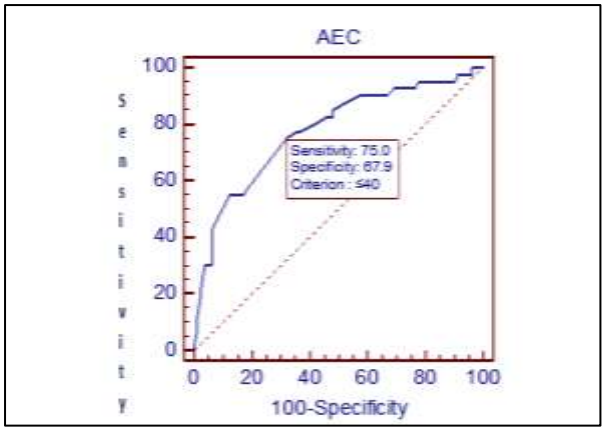

Figure 2: ROC Curve showing validity of AEC in predicting mortality.

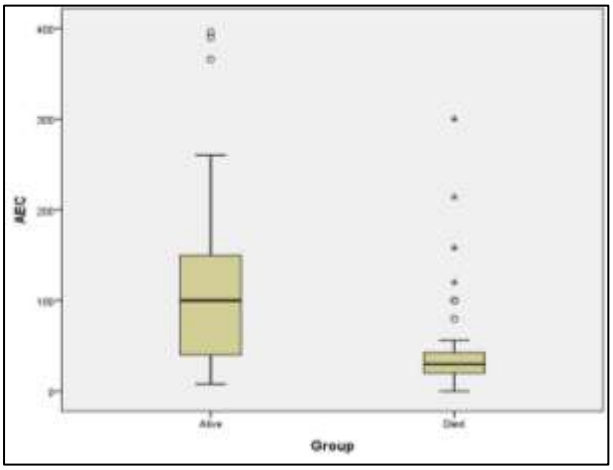

Figure 3: Mean AEC with respect to patients who died and alive.

DISCUSSION

Blood eosinophil count is being used since long as a marker of acute infection. Most of the allergic and parasitic infections show eosinophilia but relationship between eosinopenia and poor prognosis and mortlity outcomes in AECOPD is determined in this study. Study included a total of 121 patients of acute exacerbation of COPD. Mean age of patients was 62.07±10.78 years of which 79.3% (N=96) were males and 20.7% (N=25) were females.

Overall the patients were divided into two groups one with eosinopenia and other without eosinopenia. There was no significant difference between the two groups for sex, current smoking, WBC count, (p value for all variables >0.05).

In the present study Arterial blood gas analysis showed respiratory acidosis picture among the eosinopenic patients. A study done by Steer et al and Groenewegen et al showed that high PCO_2 was an independent risk factor and a marker of poor prognosis in acute exacerbation of COPD.[6,7]

In our study eosinopenia was associated with increased duration of hospital stay which was found to be 9.04±5.18 as compared to non-eosinopenic patients which was 6.15±2.89 with p value of <0.001. A similar study done by Holland et al also showed that patients with eosinopenia had poor outcome in terms of increased mortality and length of stay which was an average of 8 days in eosinopenic patients and 5 days in non-eosinopenic group.[8]

In the present study need for mechanical ventilation in eosinopenia group was 73.2% and 32.3% in non-eosinopenic patients with p value of <0.001. A study done by Rahimi et al also showed that 36% of eosinopenic patients required mechanical ventilation compared to 12% in non-eosinopenic patients with p value of 0.005. Our study showed significant difference among two groups.

Present study also showed significant relationship between eosinopenia and increased risk of mortality which was 53.6% among the eosinopenia patients and 15.4% among non-eosinopenic patients being statistically significant.[9] A study by Abidi et al showed that 28 days mortality was significantly higher in patients with eosinopenia which was 34.4% and 17.9 % in patients without eosinopenia.[10]

Absolute eosinophil count in predicting mortality with a cut off of <40 cells is 75% sensitive, specificity was 67.9%, PPV was 53.6% and NPV was 84.6% determined using Youdens index.

CONCLUSION

The present study is an effort to provide insight to know the efficacy of eosinopenia as a marker of outcome in patients with acute exacerbation of COPD with respect to duration of hospital stay, need for mechanical ventilation and in-patient mortality which is an easy and in expensive marker which can help in management of patients and reduce complications and improve survival rates. Observation showed that patients with eosinopenia had poor outcome in the form of prolonged duration of hospital stay, increased need for mechanical ventilation and higher risk of mortality.

ACKNOWLEDGEMENTS

Authors would like to thanks to patients and their relatives for all the cooperation provided during the study period.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of chronic obstructive

pulmonary disease, 2019. Available at: https://goldcopd.org/wpcontent/uploads. Accessed on 23 July 2021.
2. Buist AS, Vollmer WM, Burnie MA. Worldwide burden of COPD in high- and low-income countries. Part I. The burden of obstructive lung disease (BOLD) initiative. Int J Tuberc Lung Dis. 2008;12(7):703-8.
3. Jindal SK, Aggarwal AN, Chaudhry K, Chhabra SK, Souza GA, Gupta D, et al. A multicentric study on epidemiology of chronic obstructive pulmonary disease and its relationship with tobacco smoking and environmental tobacco smoke exposure. Indian J Chest Dis Allied Sci. 2006;48(1):23-9.
4. Weller PF, Spencer LA. Functions of tissue-resident eosinophils. Nat Rev Immunol. 2017;17(12):746-60.
5. Croft JB, Wheaton AG, Liu Y, Xu F, Lu H, Matthews KA, et al. Urban-rural county and state differences in chronic obstructive pulmonary disease- United States, 2015. Morbidity and Mortality Weekly Report. 2018;67(7):205.
6. Steer J, Gibson J, Bourke SC. The DECAF Score: predicting hospital mortality in exacerbations of chronic obstructive pulmonary disease. Thorax. 2012;67(11):970-6.
7. Groenewegen KH, Schols AM, Wouters EF. Mortality and mortality-related factors after hospitalization for acute exacerbation of COPD. Chest. 2003;124(2):459-67.
8. Holland M, Alkhalil M, Chandromouli S, Janjua A, Babores M. Eosinopenia as a marker of mortality and length of stay in patients admitted with exacerbations of chronic obstructive pulmonary disease. Respirology. 2010;15(1):165-7.
9. Rad MH, Asgari B, Hosseinzadeh N, Eishi A. Eosinopenia as a Marker of Outcome in Acute Exacerbations of Chronic Obstructive Pulmonary Disease. Maedica. 2015;10(1):10-3.
10. Abidi K, Belayachi J, Derras Y, Khayari ME, Dendane T, Madani N, et al. Eosinopenia, an early marker of increased mortality in critically ill medical patients. Intensive Care Med. 2011;37(7):1136-42.

Cite this article as: Biradar S, Teli B, Prashanth VN. Eosinopenia as a marker of outcome in acute exacerbation of chronic obstructive pulmonary disease. Int J Adv Med 2021;8:1530-5.