IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 3 Ver.5 March. (2018), PP 18-23
www.iosrjournals.org

BODE Index Vs FEV1 In Predicting Outcome And Number Of Exacerbations In Stable COPD Patients

Dr. Naga Lakshmi Katragadda[1], Dr. J. Kundan Raja[2], Dr. K. Venkata Ramana[3], Dr. K.V.V. Vijaya Kumar[4], Dr. CH.R.N. Bhushan Rao[5], Dr. G.Samba Siva Rao[6]

1Senior Resident, Department of Pulmonary Medicine, Nizam's Institute of Medical Sciences, Hyderabad, India.
2Junior Resident, Department of Pulmonary Medicine, Andhra Medical College, Visakhapatnam, A.P., India.
3Assistant Professor, Department of Pulmonary Medicine, Andhra Medical College, Visakhapatnam, A.P., India.
4 Professor, Department of Pulmonary Medicine, Andhra Medical College, Visakhapatnam, A.P., India.
5 Professor, Department of Pulmonary Medicine, Guntur Medical college, Andhra Pradesh, India.
6 Professor & HOD, Department of Pulmonary Medicine, Andhra Medical College, Visakhapatnam, A.P., India.
Corresponding author: Dr. K. Venkata Ramana

Abstract: *The mechanisms underlying COPD exacerbations are poorly understood, and it is a high priority to identify factors that help in predicting their occurrence.*
Aim and Objectives: *The present study was conducted to assess BODE index and GOLD severity staging (based on FEV_1) in stable COPD patients, and to assess the utility of BODE index and GOLD severity staging in predicting acute exacerbations and their outcomes in the following one year. It is a hospital based prospective observational study done from September 2014 to November 2016 at Government Hospital for Chest and Communicable Diseases, Andhra Medical College, Visakhapatnam, Andhra Pradesh.*
Results:*100 stable COPD patients were enrolled and were followed up for a period of one year or until their death whichever was earlier. 6 patients were lost to follow-up. Out of 94 patients; 23.40% had a BODE index of 0-2, 28.72% had a BODE index of 3-4, 20.21% had a BODE index of 5-6 and 27.67% had a BODE index of 7-10. Out of the 94 patients, 12.76%, 20.21%, 37.23% and 29.80% were categorized into GOLD stage 1, 2, 3 and 4 respectively. 38.29% of patients experienced at least one exacerbation, out of which, 5.31% of were managed with OP-based treatment. The remaining 32.97% of patients were hospitalized, of which, 12.76% succumbed to death. BODE index seems to be a better predictor of exacerbations (AUC=0.951) than FEV_1 (AUC=0.794), with higher specificity rate. BODE index predicts OP based management of exacerbations better than FEV_1 (AUC -- 0.916 vs 0.771). BODE index was also found to be a better predictor of hospitalization rates when compared to FEV_1 (AUC—0.916 vs 0.771). BODE index was found to be a significant predictor of mortality with a AUC of 0.884 ($p<0.0001$) when compared to FEV_1 ($p=0.1379$).*
Conclusion*: BODE index and FEV_1 were predictors of number of exacerbations, OP-based management and hospitalizations, but BODE index was found to be a better predictor than FEV_1. BODE index was also found to predict outcomes in terms of mortality unlike FEV_1.*
Keywords: *COPD (Chronic Obstructive Pulmonary Disease), GOLD (Global Initiative for Obstructive Lung Diseases), BODE Index (BMI, Obstruction, Dyspnea, Exercise capacity), FEV_1 (Forced Expiratory Volume in 1sec), Exacerbations*

Date of Submission: 26-02-2018 Date of acceptance: 12-03-2018

I. Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases[1]. COPD will become the third most common cause of death and the fourth cause of disability in the world by the year 2020[2]. COPD exacerbations are defined as an acute worsening of respiratory symptoms that result in additional therapy[3,4]. As COPD progresses, patients develop more frequent and severe exacerbations[5,8] and have an increased rate of emergency room visits and hospitalizations.[5,7]. Exacerbations of COPD are important events in the course of the disease because they accelerate the rate of decline of lung function[7,8] are associated with significant mortality and have a high socioeconomic burden[9]. Thus, it is a high priority to have a proper and simple tool that helps in predicting

exacerbations.

The BODE index was developed in 2004 by Celli and colleagues, for predicting mortality risk of COPD patients which includes Body mass index (B), Degree of airflow obstruction (O), Dyspnea (D) and Exercise capacity (E).

II. Aims and Objectives

1. To assess BODE index and GOLD severity staging in stable COPD patients.
2. To assess predictor value of BODE index and GOLD severity staging in number of acute exacerbations and their outcome in the following one year.

III. Material and Methods

It is a prospective study done at GHCCD Visakhapatnam, Andhra Pradesh, from September 2014 to November 2016 with follow up of 1 year at an interval of 4 months or until death whichever was earlier.

Inclusion criteria:

- 100 Stable COPD patients (without acute exacerbations for at least 8 weeks prior to enrolment into the study), Age >40 years and post bronchodilator $FEV_1/FVC < 0.7$ were included in the study.

Exclusion criteria:

- Patients with bronchial asthma, recent MI, AE COPD, other major life-threatening illness were excluded from study.

The study population was assessed for BMI, Air flow obstruction, MMRC dyspnea scale, exercise capacity (measured based on 6-minute walk test according to ATS guidelines). Based on these variables (BODE Index score) patients were grouped in to 4 subgroups 0-2, 3-4, 5-6, 7-10. Also, patients were categorized on GOLD severity staging in to stage 1, 2, 3, and 4. Comparison was done between these groups. During their follow up period, patients were assessed for number of exacerbations and exacerbation outcomes.

Data Analysis:

Mean ± SD was used for baseline characteristics. The chi-square test of contingency tables was used to compare proportions for discrete variables. The main outcome measure was exacerbation occurrences during 1year. We evaluated the influence of GOLD staging (GOLD I, II, III, and IV) and BODE classes (classes 1, 2, 3, and 4) as continuous variables on exacerbation by logistic regression and by the area under the receiver-operator curve (ROC). P value<0.05 was considered statistically significant.

IV. Results

Out of 100 patients, 6 patients were lost to follow up; 70 were males and 24 were females. Smoking was the most common risk factor associated with COPD and was seen in 89.4% of the cases. The baseline characteristics of these patients are summarized in Table#1.

Table no 1: Mean values of various patient variables in the study population

Parameter	Mean	Standard Deviation
Age	61.30	8.71
BMI	24.08	6.00
FEV_1	45.17%	18.96%
MMRC	1.19	1.01
6MWD	277.86	92.50
BODE	4.61	2.68

Table#2 shows classification of patients according to BODE index score and most of them are equally distributed between an index of 3-4 and 7-10.

Table no 2: Classification of patients according to BODE index score

BODE Index	Male	Female	Total
0-2	20 (90.9%)	2 (9.09%)	22 (23.40%)
3-4	20 (74.07%)	7 (25.9%)	27 (28.72%)
5-6	8 (42.1%)	11(57.8%)	19 (20.21%)
7-10	22 (84.6%)	4 (15.3%)	26 (27.67%)
Col. Total	70	24	94

Classification of GOLD severity staging is mentioned in Table#3 and majority of patients were in GOLD stage-3 (37.23%)

Table no 3: Classification of patients according to GOLD severity

GOLD staging	Male	Female	Total
1 (≥80)	10 (83.3%)	2 (16.6%)	12 (12.76%)
2 (50-79)	12 (63.1%)	7 (36.8%)	19 (20.21%)
3 (30-49)	26 (74.2%)	9 (25.7%)	35 (37.23%)
4 (<30)	22 (78.5%)	6 (21.4%)	28 (29.80%)
Col. Total	70	24	94

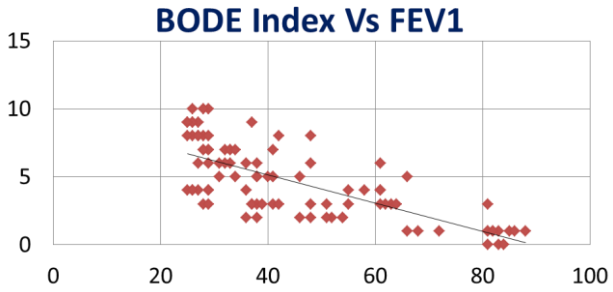
As BODE index increased, the stage (GOLD Severity staging) of disease also increased which was found to be statistically significant (p = 0.001). Please refer Table#4.

Table no 4: BODE index vs GOLD Severity staging

BODE Index	Stage 1	Stage 2	Stage 3	Stage 4	Total
0-2	11 (50%)	7 (31.8%)	4 (18.1%)	0 (0%)	22
3-4	1 (3.7%)	10 (37.03%)	8 (29.6%)	8 (29.6%)	27
5-6	0 (0%)	2 (10.5%)	15 (78.9%)	2 (10.5%)	19
7-10	0 (0%)	0 (0%)	8 (30.7%)	18 (69.2%)	26
Col. Total	12	19	35	28	94

P = 0.001

A significant negative correlation was found between BODE index and FEV_1 as shown in Figure.1



Pearson Coefficient = -0.736
P value <0.01

Figure 1: BODE Index vs FEV_1

Out of 94 patients, 36 (38.29%) patients experienced at least one exacerbation during one year follow up period. Out these 36 patients with exacerbations, 5(5.31%) were managed with OP-based treatment and the remaining 31(32.97%) patients were hospitalized in which 12(12.76%) patients died.

As the BODE index increased, the percentage of exacerbations on follow up also increased. Patients with BODE index 0-2 never experienced any exacerbation, whereas 92.3% of patients having BODE index 7-10 experienced at least one exacerbation during follow up. Out of four GOLD stages, majority of patients (52.77%) with GOLD stage 4 experienced exacerbations.

Patients with a higher BODE index (7-10) experienced more no. of (≥2) exacerbations when compared to patients with lower (3-4) BODE index. (p=0.007) Whereas GOLD severity staging was not significantly associated with no. of exacerbations. (p=0.09)

Table no 5: BODE index Vs FEV_1 in predicting exacerbations

Exacerbations	BODE Index	FEV_1
AUC	0.951	0.794
P Value	<0.0001	<0.0001
Associated Criterion	>5	≤48
Sensitivity	83.33	94.44
Specificity	91.38	50.00

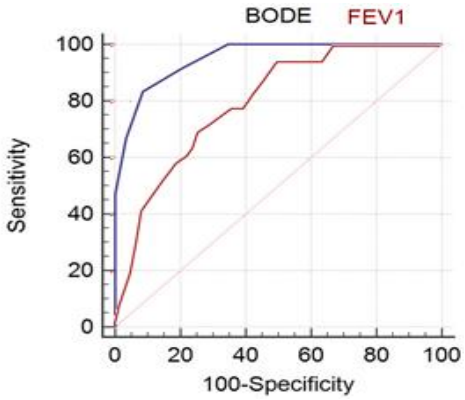


Figure 2: ROC curves of BODE Index vs FEV$_1$ in predicting exacerbations

BODE index was also able to predict the outcome of exacerbations better than FEV$_1$ alone. Outcomes were measured in terms of OP based management, hospitalizations and mortality (Table#6,7,8 and Figure#3,4,5).

Table no 6: BODE Index vs FEV$_1$ in predicting OP Based Management of exacerbations

OP Based Treatment	BODE Index	FEV$_1$
AUC	0.916	0.771
P Value	<0.0001	0.0033
Associated Criterion	≤6	>34
Sensitivity	100.00	80.00
Specificity	77.42	70.97

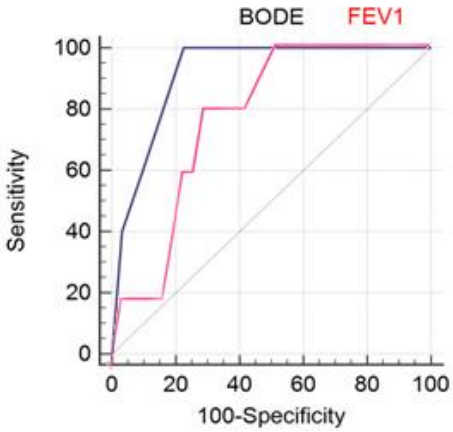


Figure 3: ROC curves of BODE Index vs FEV$_1$ in predicting OP Based Management of exacerbations

Table no 7: BODE Index vs FEV$_1$ in predicting Hospitalization

Hospitalization	BODE Index	FEV$_1$
AUC	0.916	0.771
P Value	<0.0001	0.0033
Associated Criterion	>6	≤34
Sensitivity	77.42	70.97
Specificity	100.00	80.00

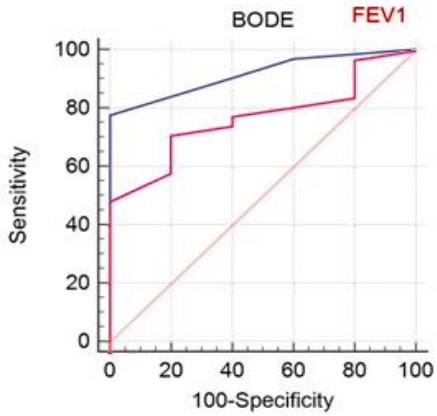


Figure 4: ROC curves of BODE Index vs FEV$_1$ in predicting Hospitalization

Table no 8: BODE Index vs FEV$_1$ in predicting Mortality

Mortality	BODE Index	FEV$_1$
AUC	0.884	0.619
P Value	<0.0001	0.1379
Associated Criterion	>5	≤48
Sensitivity	91.67	91.67
Specificity	70.73	36.59

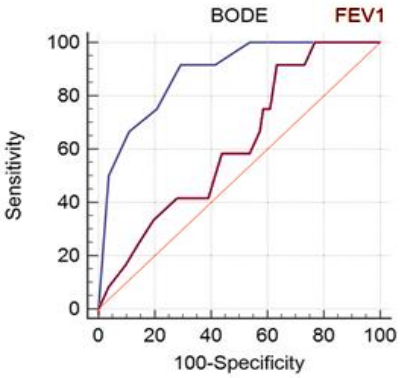


Figure 5: ROC curves of BODE Index vs FEV$_1$ in predicting Mortality

Table no 9: Factors predicting exacerbation and mortality

	Exacerbation Prediction			Mortality Prediction	
	Odds Ratio	*P value*		*Odds Ratio*	*P value*
BMI	0.8200	<0.001		0.9824338	0.735
FEV$_1$	0.9208954	<0.001		0.9679797	0.139
MMRC Dyspnea scale	4.20944	<0.001		4.729377	<0.001
Exercise Capacity	0.9825172	<0.001		0.9747843	<0.001
BODE Index	3.531692	<0.001		2.08113	<0.001
GOLD Staging	4.252382	<0.001		1.985086	0.075

V. Discussion

Exacerbations:

Each component of the BODE index showed a significant relationship with the number of exacerbations. Our study showed that patients with a BODE index between 7-10 and GOLD stage 4 have experienced the highest number of exacerbations and therefore, are a potential high-risk population. BODE index was a better predictor of exacerbations (AUC=0.951) than FEV$_1$ (AUC=0.794), with higher specificity rate. Improved home based

healthcare and frequent, regular follow up visits might be a good strategy in these patients to reduce exacerbations and improve quality of life.

OP based management of exacerbations:

Majority of patients with low BODE index (≤6) and GOLD stage 3, were managed by OP based treatment. BODE index predicts OP based management of exacerbations better than FEV_1 (AUC -- 0.916 vs 0.771).

Hospitalization:

Majority of patients with high BODE index (>6) and GOLD stage 4, were hospitalized. BODE index was also found to be a better predictor of hospitalization rates when compared to FEV_1 (AUC—0.916 vs 0.771).

Mortality:

Surprisingly, only two components—Dyspnea scale and Exercise capacity—showed a significant relationship with mortality, while BMI did not. Contrary to general perception, airflow obstruction (FEV_1) i.e., GOLD severity staging did not seem to be a significant predictor of mortality. BODE index as a whole, seemed to show a significant relationship with mortality. This finding assumes significance, in that, BODE index scores can be used to risk stratify and priority manage patients with higher scores, as they are more prone to increased rates of mortality.

A significant negative correlation exists between FEV_1 and BODE index—as FEV_1 decreases, BODE index increases.

Thus, BODE index seems to be a good predictor of exacerbations and it's outcome in stable COPD patients and can be used to stratify patient population for effective treatment strategies and in effect, improved survival rates.

VI. Conclusion

Although the unidimensional GOLD classification system and the multidimensional BODE Index, along with its individual components, seem to be predictors of exacerbation in stable COPD patients, BODE index seems to predict exacerbations more effectively. BODE index and two of its components -- dyspnea scale and exercise capacity, seem to be better predictors of mortality when compared to GOLD severity staging. COPD is a complex airway disease and the importance of a multidimensional tool like BODE index in stratification of COPD patients is evident from our study.

References

[1] Global strategy for the diagnosis, management and prevention of Chronic Obstructive Pulmonary Disease-2018 report.
[2] Murray CJL, Lopez AD. Mortality by cause for eight regions of the world: Global Burden of Disease Study. Lancet 1997;349:1269e76.
[3] Wedzicha JA, Seemungal TA. COPD exacerbations: defining their cause and prevention. Lancet 2007; 370(9589): 786-96.
[4] Seemungal TA, Donaldson GC, Paul EA, Bestall JC, Jeffries DJ, Wedzicha JA. Effect of exacerbation on quality of life in patients with chronic obstructive pulmonary disease. Am J Respir Crit Care Med 1998; 157(5 Pt 1): 1418-22.
[5] Pauwels R, Buist SA, Calverley P, et al. Global strategy for the diagnosis, management and prevention of chronic obstructive pulmonary disease. NHLBI/WHO Global Initiative for Chronic Obstructive Lung Disease (GOLD). Workshop summary. Am J Respir Crit Care Med 2001;163:1256e76.
[6] Vestbo J. Epidemiology of exacerbations in COPD. In: Siafakas N, Anthonisen N, Georgopoulos D, editors. Acute exacerbations of chronic obstructive pulmonary disease. New York: Marcel Dekker Inc; 2003.
[7] Donaldson GC, Seemungal TAR, Bhowmik A, et al. Relationship between exacerbation frequency and lung function decline in chronic obstructive pulmonary disease. Thorax 2002;57:847e52
[8] Kanner RE, Anthonisen NR, Connett JE. Lower respiratory illnesses promote FEV(1) decline in current smokers but not ex-smokers with mild chronic obstructive pulmonary disease: results from the lung health study. Am J RespirCrit Care Med 2001;164:358-64
[9] Seemungal TA, Donaldson GC, Bhowmik A, Jeffries DJ,Wedzicha JA. Time course and recovery of exacerbations in patients with chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2000;161:1608-13

Dr. K. Naga Lakshmi "BODE Index Vs FEV_1 In Predicting Outcome and Number Of Exacerbations In Stable COPD Patients. "IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 3, 2018, pp 18-23.