Study to evaluate the relationship between the BODE Index and CRP in COPD patients in a tertiary care centre

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Background: Chronic obstructive pulmonary disease (COPD) is a respiratory disease which is associated with abnormal inflammatory response of the lungs to stimuli, leading to a progressive airflow limitation that is not fully reversible. COPD is the third leading cause of death worldwide, with an estimated burden of COPD of about 37.8million cases. Of late, the disease has been discussed widely due to its systemic nature. A combined index of multiple mortality predictors for COPD, known as the "BODE index", was developed to understand this aspect of the disease. The BODE index, which includes Body Mass Index (BMI), Airflow Obstruction (FEV1), Dyspnea (MMRC), and Exercise Capacity (6MWT), is a multidimensional tool for assessing disease severity. C-reactive protein (CRP), an acute-phase reactant, is commonly elevated in COPD and may reflect systemic inflammatory burden.

Objective: This study aimed to evaluate the relationship between CRP levels and the BODE index in stable COPD patients.

Methods: A cross-sectional study was conducted on 110 stable COPD patients. CRP levels and BODE index components were measured and analysed using the Pearson correlation coefficient.

Results: A weak but statistically significant positive correlation was found between CRP and the BODE index ($r = 0.258$, $p = 0.006$). CRP was also significantly associated with lower FEV1, shorter 6MWT distance, and higher MMRC scores.

Conclusion: CRP may be a useful marker for systemic inflammation and disease severity in stable COPD patients.

Keywords: Chronic obstructive pulmonary disease, COPD, BODE index, CRP

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Introduction

Chronic obstructive pulmonary disease (COPD) is a disease state characterised by airflow limitation that is not fully reversible. The airflow obstruction is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles and gas.[1].According to WHO, COPD is the third leading cause of death worldwide, causing 3.23 million deaths in 2019.The estimated burden of COPDinIndiaisabout37.8millioncases[2]. A combined index of multiple mortality predictors for COPD, known as the "BODE index", was developed to understand the systemic nature of the disease. The components of the index are: body mass index (BMI), airway obstruction (O), dyspnea(D) and exercise capacity (E). It has been reported as a better mortality predictor than forced expiratory volume in 1 second(FEV1)[3]. C-reactive protein is an acute phase protein which reflects the total systemic burden of inflammation of individuals and is increased in COPD in stable condition [4].

In this study, the role of C-reactive protein in COPD, its level and correlation with lung function (forced expiratory volume in 1 second (FEV1) and its association with predictors of outcome (Body Mass Index, Dyspnoea according to MMRC dyspnoea scale,6-minute walk distance, BODE index)of disease will be analyzed in stable patients.

Materials and Methods

The present study was approved by institutional ethical committee. A present cross-sectional study was conducted at Swaroop Rani Hospital, Moti Lal Nehru Medical College, Prayagraj, from July 2021 to June 2022. All stable COPD patients attending outpatient department of medicine and pulmonary medicine of hospital were enrolled. COPD was defined as ratio of FEV1/FVC less than 70% after 20 minutes of salbutamol administration. Patients with other inflammatory diseases (e.g inflammatory bowel disease, rheumatological diseases, vasculitis, ILD, active pulmonary TB), presence of atopy, history of MI in last 6 months, decompensated cardiovascular disease & walking disability were excluded. CRP was sent, & BODE INDEX was calculated by using its parameters. BMI was measured as weight(kg)/surface area(m2). Airway obstruction was taken as FEV1%, dyspnea was measured on MMRC dyspnea scale, & Exercise capacity was assessed by the 6-minute walking test in meters.

The relationship between CRP and the BODE INDEX and its components was assessed using a scatter diagram. Also relation between the BODE INDEX and disease duration was observed.

Data analysis was performed by SPSS for Windows version 16.0(SPSS, Chicago, IL, USA). Quantitative data were described using mean +_ SD. The relation between two variables was calculated using the Pearson Correlation Coefficient.

Results

A total of 110 COPD patients were enrolled, of which 82(74.5%) were males and 28(25.5%)were females. The mean age of the participants was 54.88+-8.01 years, and the study population was mostly comprised of subjects with 50-60 years of age. Mean BMI of subjects was 25.08+_3.08 kg/m² for the entire population. Mean FEV1%, MMRC, and 6MWT of the study subjects were 53.09+_9.32%, 2.67+_0.65 and 113.90+_40.12m, respectively. The mean BODE index of study subjects was calculated to be 5.99+_1.50, and CRP value was 11.72+_2.44.(Table1)

Table 1: Gender wise mean values of various parameters

Parameters	MALE(82)	FEMALE(28)	TOTAL(110)
BMI(Kg/m²)	24.51+_2.92	23.90+_3.12	25.08+_3.08
FEV1(L)	53.61+_9.96	51.57+_9.02	53.09+-9.32
MMRC	2.67+_0.64	2.68+_0.67	2.67+_0.65
6MWT(m)	117.07+_41.91	104.64+_38.92	113.90+_40.12
BODE INDEX	5.93+_1.53	6.32+_1.33	5.99+_1.50
CRP(mg/dl)	11.68+_2.54	11.87+_2.22	11.72+_2.44

There was a negative correlation (r=0.284) between FEV1 and CRP, which was statistically significant (Fig. 1).

There was a positive correlation(r=.638) between MMRC score andCRP which was statistically significant(p=.0001).{fig 2}

There was a negative correlation between 6MWT and CRP(r=0.364) which was statistically significant(p=.0001).{fig3}

There was a weak positive correlation between BODE INDEX and CRP(R=0.258) which was statistically significant(p=0.006){fig4}

There was a positive correlation (r=0.281) between BODE INDEX and disease duration which was statistically significant(p=0.0029){fig5}

Discussion

The most recently discussed topic in COPD in last few years is its inflammatory and systemic nature. Several clinical tests and biomarkers have been developed for evaluation of systemic effects of disease[5]. A weak correlation has been defined between pulmonary function tests, especially FEV1 and clinical outcomes, including severity of dyspnea and other symptoms, mortality, health status, quality of life and frequency of exacerbations[6], [7]. The BODE index has been suggested as a new follow-up tool for evaluation of COPD patients [8]. CRP is another systemic biomarker that has been widely used for inflammatory diseases like COPD[4].

In this cross-sectional study, conducted on 110 COPD patients, of which 82 were males and 28 were females with a mean age of 56.25 ±8.09 years and 50.85±6.1 years, respectively, we found a weak positive but statistically significant correlation(r=0.258,p=0.006) between bode index and CRP level in patients with COPD. Previous studies also confirm correlation between BODE index and CRP level. Nurhan Sarioglu et al [9] showed that CRP levels have a weak but statistically significant correlation(r=0.2,p=0.014) while TNFα and IL8 did not show a correlation. They also found that CRP was not correlated with FVC, FEV1, or FEV1/FVC. However, a significant relationship was found between CRP and SGRQ Score(p=0.015). Regarding outcome of disease based on BODE stage, mean serum CRP levels were found to be significantly increased in severe cases. It was also found to be significantly increased in patients presenting with acute exacerbation of COPD. De Torres and coworkers [10] indicated that serum CRP levels significantly increased with aggravation of disease, and correlation was found with BODE index (r=0.17, p=0.050). Rakesh Kumar and P Nigam(11) showed that there was a significant correlation of CRP with BODE index(r=0.4,p=0.0001) in patients who presented with acute exacerbation of COPD. Therefore, although we expect inflammatory process to be worse and inflammatory markers to be increased by increasing severity of disease, more studies are required in this regard.

Conclusion

This study demonstrates weak positive but statistically significant correlation between CRP levels & various compo. of BODE index in COPD patients.

Elevated CRP levels were also seen to be associated with lower FEV1, reduced 6-minute walk distance, and higher MMRC dyspnea scores, suggesting greater disease severity. A positive correlation between CRP and the overall BODE index suggests that systemic inflammation, as reflected by CRP, may serve as a useful marker for disease burden and prognosis in COPD. These findings emphasise the role of CRP to be used as a marker in the assessment of systemic involvement and guiding clinical management in COPD patients.

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