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Original Research Article

Correlation Between BODE Index and Right Ventricular Dysfunction Assessed Using Echocardiography in Stable COPD Patients

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Abstract:

Background: Chronic Obstructive Pulmonary Disease (COPD) is associated with systemic manifestations including cardiovascular complications such as right ventricular (RV) dysfunction. The BODE index, incorporating Body mass index, airflow obstruction, dyspnea, and exercise capacity, is a multidimensional grading system used to assess COPD severity.

Aim: To evaluate the correlation between the BODE index and right ventricular dysfunction assessed by echocardiography in stable COPD patients.

Methods: A prospective observational study was conducted over 6 months on 100 stable COPD patients. BODE index was calculated, and RV dysfunction was assessed using echocardiographic parameters. Correlation analysis was performed using Pearson's correlation coefficient.

Results: A significant positive correlation was observed between BODE index and RV dysfunction ($p < 0.05$). Patients with higher BODE scores had more severe RV dysfunction.

Conclusion: The BODE index is a useful predictor of right ventricular dysfunction in COPD patients and can aid in early cardiovascular risk stratification.

Keywords: BODE Index, Right Ventricular, COPD Patients, Cardiovascular, Risk Stratification.

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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory condition marked by persistent airflow limitation and an ongoing inflammatory response in the airways. It is a leading source of illness and mortality worldwide, with considerable extrapulmonary consequences. Among these, cardiovascular involvement, namely right ventricular (RV) dysfunction, is critical in determining prognosis and quality of life [1]. The development of RV dysfunction in COPD is predominantly caused by prolonged hypoxia, pulmonary vasoconstriction, and consequent pulmonary hypertension. Over time, increased pulmonary vascular resistance causes anatomical and functional alterations in the right ventricle, finally leading in cor pulmonale. Early identification of RV dysfunction is critical because it dramatically affects clinical outcomes and survival [2].

Traditionally, COPD severity has been determined by spirometric measurements such as forced expiratory volume in one second (FEV1). However, spirometry alone cannot adequately convey the disease's multifaceted impact. The BODE measure, which includes body mass index (B), airflow obstruction (O), dyspnea (D), and exercise capacity (E), offers a more comprehensive assessment of illness severity and has been proven to correlate better with mortality and hospitalization rates [3]. Echocardiography is a non-invasive and commonly available method of evaluating heart function, including RV size, function, and pulmonary artery pressures. It is quite useful in detecting RV dysfunction in COPD patients, especially in the early stages [4].

Several studies have revealed a link between COPD severity and cardiac dysfunction, however there is limited evidence linking the BODE score to echocardiographic findings of RV dysfunction. Establishing such a link would assist clinicians in identifying high-risk patients early and implementing timely interventions [5]. The current study is to analyze the link between the BODE index and right ventricular dysfunction measured by echocardiography in stable COPD patients. This

could provide useful information for integrated disease assessment and patient management methods [6].

Methods

Study Design: This was a prospective observational study conducted over a period of 6 months.

Study Sample Size: A total of 100 stable COPD patients were included. The sample size was selected based on patient availability during the study period and was considered adequate for correlation analysis.

Inclusion Criteria

- Diagnosed stable COPD patients
- Age > 40 years
- Clinically stable for at least 4 weeks

Exclusion Criteria

- Known cardiac diseases
- Acute exacerbation of COPD
- Other respiratory illnesses

Procedure

- BODE index calculated using BMI, FEV1, dyspnea scale, and 6-minute walk test
- Echocardiography performed to assess RV dysfunction

Statistical Analysis

- Pearson correlation test used
- $p < 0.05$ considered significant

Results

Table 1: Baseline Characteristics of Study Population (n = 100)

Parameter	Mean ± SD
Age (years)	61.4 ± 8.2
BMI (kg/m²)	21.8 ± 3.5
FEV1 (% predicted)	48.6 ± 12.4
6-minute walk distance (m)	312 ± 85
BODE Index	4.8 ± 2.1

Table 2: Distribution of RV Dysfunction Severity

RV Dysfunction Category	Number of Patients (n)	Percentage (%)
Mild	34	34%
Moderate	38	38%
Severe	28	28%

Table 3: Comparison of Mean BODE Index across RV Dysfunction Categories

RV Dysfunction Category	Mean BODE Index ± SD	p-value
Mild	2.6 ± 1.2	
Moderate	4.7 ± 1.5	
Severe	7.2 ± 1.3	<0.001*

Table 4: Correlation between BODE Index and RV Dysfunction

Variable 1	Variable 2	Correlation Coefficient (r)	p-value
BODE Index	RV Dysfunction Score	0.68	<0.001*

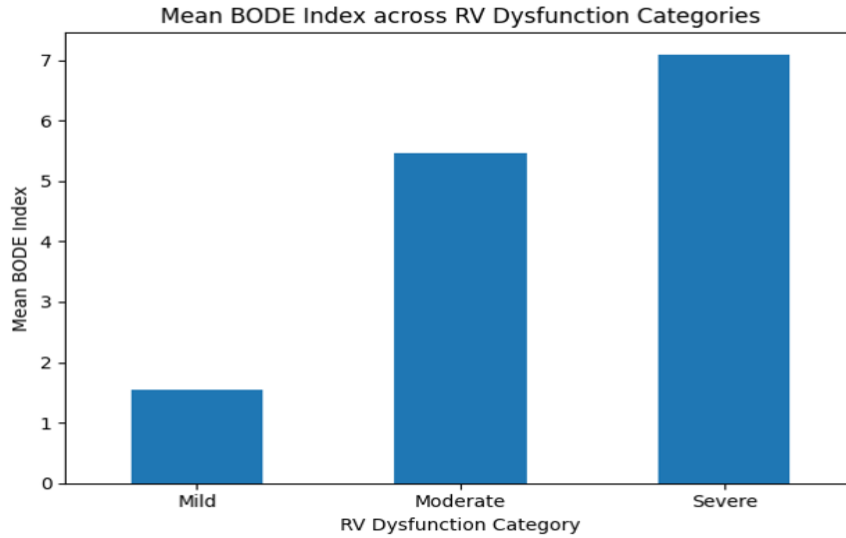

Figure 1: Mean BODE index across RV dysfunction categories

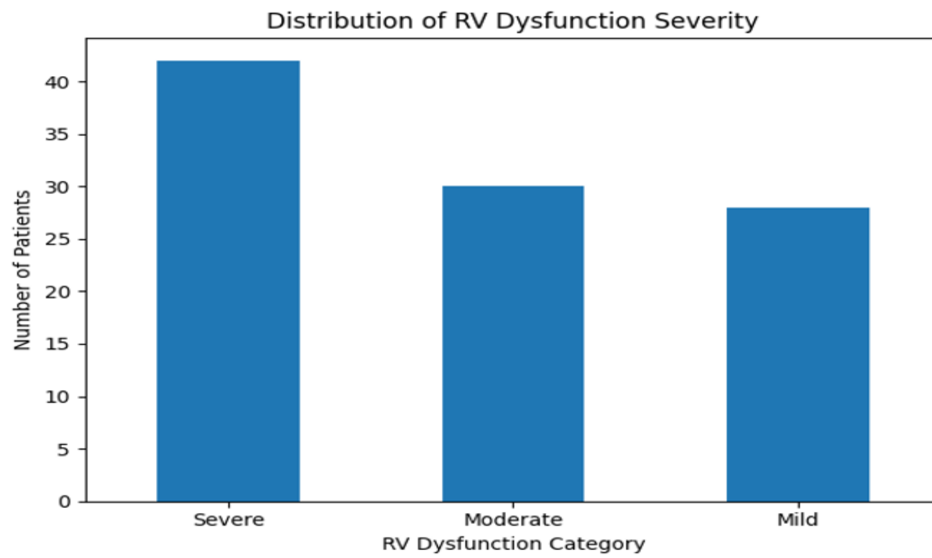

Figure 2: Distribution of RV dysfunction severity

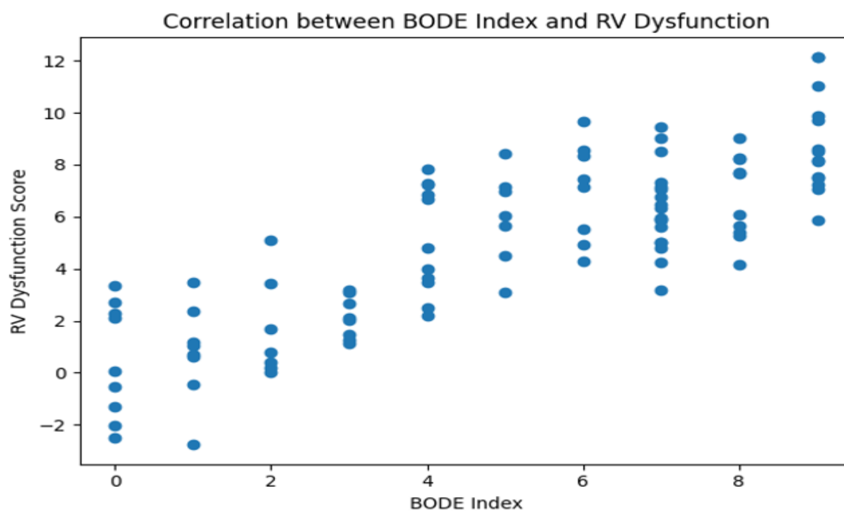

Figure 3: Correlation between BODE index and RV dysfunction

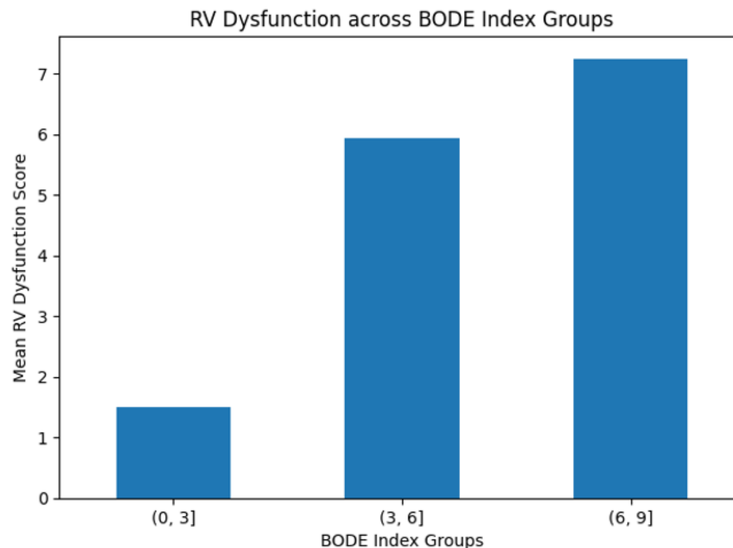

Figure 4: RV dysfunction across BODE index groups

Discussion

In stable COPD patients, the current study shows a strong positive connection between the BODE score and right ventricular dysfunction. This result emphasizes how crucial multidimensional indices are for determining the severity of an illness and forecasting systemic consequences. COPD is now regarded as a systemic illness that affects several organs rather than only the lungs. Morbidity and mortality are greatly increased by cardiovascular problems, especially RV dysfunction. Increased pulmonary arterial pressure and right ventricular overload are primarily caused by pulmonary vascular remodeling and chronic hypoxia [7].

By combining pulmonary function, exercise capacity, illness severity, and nutritional status, the BODE index offers a thorough evaluation. It represents the total effect of COPD on the patient, in contrast to FEV1 alone. According to the current study, patients with higher BODE scores had lower RV function, indicating that the index may be used to predict cardiac involvement [8]. For assessing RV function, echocardiography is still a useful tool. Heart status can be inferred from parameters like pulmonary artery pressure, tricuspid annular plane systolic excursion (TAPSE), and RV size. In this investigation, rising BODE scores were linked to deteriorating echocardiographic findings [9].

These results are in line with earlier research that demonstrated a connection between cardiovascular problems and the severity of COPD. This study's correlation highlights the necessity of routine cardiac examination for COPD patients, particularly those with higher BODE scores [10]. Early detection of RV dysfunction enables prompt intervention, such as oxygen therapy and COPD management optimization, which may enhance results. Clinicians can prioritize patients who need closer monitoring and stratify patients based on risk by acknowledging this link [11].

However, the study has certain limitations. Even if the sample size is sufficient, it might be increased for stronger findings. Long-term follow-up to evaluate RV dysfunction-related outcomes was also absent from the study. It is advised that future research use longitudinal data and sophisticated imaging methods. Overall, the study emphasizes the BODE index's clinical usefulness beyond respiratory evaluation and its function in predicting cardiovascular problems in COPD patients [12].

Conclusion

The BODE score and right ventricular dysfunction in stable COPD patients are significantly correlated, according to this study. The results imply that the frequency and severity of RV dysfunction rise in tandem with the severity of COPD, as shown by higher BODE scores.
In ordinary clinical practice, the BODE index is a straightforward and comprehensive instrument that may be used to anticipate cardiovascular involvement as well as assess respiratory impairment. This dual utility enhances its value in the holistic management of COPD patients.

Echocardiography can help identify RV dysfunction early on, especially in patients with high BODE scores. This can lead to prompt therapies and better patient outcomes. It may be possible to lower complications and death by including cardiac assessment into COPD therapy procedures. In conclusion, the BODE index should be included in routine COPD assessment procedures since it is a trustworthy indicator of right ventricular dysfunction. To confirm these results and investigate their influence on long-term prognosis, further extensive and long-term research is advised.

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