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COMPARATIVE ANALYSIS OF COPD ASSESSMENT TEST (CAT) WITH BODE INDEX AS AN TOOL IN ASSESSING DISEASE SEVERITY IN STABLE COPD PATIENTS

Medicine

Riturag Thakuria Assistant Professor, Department of Medicine, Silchar Medical College

Raj Kumar Bhattacharjee Post Graduate Trainee, Department of Medicine, Silchar Medical College

ABSTRACT

Background- COPD, being a multisystem disease is underestimated by FEV1% predicted alone which necessitates use of more comprehensive tools like BODE Index as well as various questionnaires to assess disease impact effectively.
Aim- To analyse CAT score with BODE Index in assessing disease severity in stable COPD patients.
Materials and methods- A cross-sectional study was conducted in 50 patients. BODE Index and CAT score were correlated by Pearson's correlation coefficient.
Results - Patients were mostly from GOLD (2 and 3) categories with a male predominance and mean age, body mass index,FEV1% predicted, 6 minute walk distance, BODE Index and CAT score of 62.56± 8 years, 20.21±2.59 kg/m^2, 49.92±16.95%, 223.3±60.67 metres, 5.96±2.05 and 21.12±4.88 respectively. CAT score was strongly correlated with the BODE index($r=0.7007$, $p<0.00001$).
Conclusion- CAT questionnaire, being reliable and sensitive in assessing disease impact should be routinely employed especially in primary health care settings where BODE index estimation may not always be feasible.

KEYWORDS:

CAT, BODE, GOLD

INTRODUCTION

Currently COPD has been acknowledged by the "WHO "as the fourth commonest cause of death worldwide, exceeded only by myocardial infarction, malignancy and stroke and it is expected to rise to the third position by 2030 (Chatila,2008). The Global Burden of Disease Study (GBDS) projected that globally COPD is the fifth leading cause of loss of 'Disability Adjusted Life Years (DALYs), thus accounting for enormous social and economic burden worldwide (WHO Report, 2000).

In COPD, besides progressive decline in respiratory function there also exist various systemic effects that lead to permanent disability in the form of dyspnea, fatigue, limited exercise capacity, and a negative impact on quality of life (Jones, 2006). Previously, as per GOLD criteria, Forced Expiratory Volume in one second (FEV1) in percent of predicted, had been used for determining the severity of COPD and therapeutic guidelines were configured based on FEV1 staging. But it has been observed that in patients with COPD, FEV1 correlates poorly with the symptoms, quality of life, exacerbation frequency and exercise intolerance which means the multi-dimensional characteristics of COPD may be underestimated if FEV1% is used alone in evaluating COPD patients. Further, the systemic manifestations of COPD are not reflected well by the FEV1 (GOLD 2016, Pauwels 2001)

Therefore, the BODE multidimensional index was developed by Celli et al which was based on four relevant variables related to COPD mortality that involves both pulmonary and systemic factors: body mass index (B of body mass index), airflow obstruction according to FEV1 (O of obstruction), dyspnea severity according to Modified Medical Research Council (MMRC) (D of dyspnea) and exercise capacity based on the 6 Minute Walk Distance (6MWD) test (E of exercise). They showed that this index is a better predictor of mortality for COPD patients than the classical variable (FEV1) alone. Besides, the BODE Index is easily applicable (Celli, 2004). There have been various studies on the utility of BODE Index in COPD patients such as Sarioglu et al (Sarioglu, 2010) and Lari et al (Lari, 2013) to name a few. All studies conducted so far observed that BODE index has got a strong correlation with various prognostic and follow up clinical parameters of COPD and systemic inflammation and its use should be thoroughly considered for routine evaluation of such patients.

Similarly, various questionnaires have been developed to assess the impact of COPD on patient health as well as quality of life such as the St George's Respiratory Questionnaire (SGRQ) (Jones,1991), Chronic Respiratory Disease Questionnaire (CRQ) (Larson, 1993) and the COPD Clinical Questionnaire (CCQ) (Molen, 2003). These are valid, reliable and widely used in clinical trials but their drawback is that some are too lengthy and complex to routine use in daily clinical practice. By contrast, a new clinical assessment tool called the CAT (COPD Assessment Test) devised in 2009 to assess the impact of COPD on the patient's health has been recommended as a shorter, quick and easier comprehensive measure of symptoms, with a CAT score ≥ 10 indicating a high level of symptoms. The CAT consists of eight items for the evaluation of the impact of COPD on health status (Gerstman, 2008) and (Ghobadi, 2012).

Consequently CAT score evaluating health status was approved to evaluate the impact of COPD on health status. The validation studies have shown that it has similar properties as St. George`s Respiratory Questionnaire (SGRQ) (GOLD 2016)

Since its introduction the utility of CAT scoring has been evaluated in many studies. Notable among them were the observations by Ghobadi et al (Ghobadi, 2012) who concluded that CAT is linked to severity of airflow limitation and GOLD classification in stable COPD patients and Ladeira et al (Ladeira, 2015) who observed that CAT is correlated to BODE Index and thus CAT should be used as a complement in the evaluation of the true impact of COPD on a patient's daily life. Recently use of CAT scoring has been advocated by GOLD for combined assessment of a patient with COPD and subsequent grouping of patients into four groups- Group A, B, C and D (GOLD, 2016)

Though CAT is a recently developed questionnaire in assessing the quality of life in COPD patients and many studies have been conducted in assessing its efficacy but still experience of its use in COPD patients remains limited in the locality of the state of Assam data where COPD is highly prevalent. In light of these facts the present study was undertaken to understand the correlation between CAT Questionnaire and BODE Index.

AIMS AND OBJECTIVES

1. To estimate the COPD Assessment Test Score (CAT Score) in patients with COPD.
2. To correlate the CAT Score with the BODE Index of all such patients.

MATERIALS AND METHODS

A hospital based cross-sectional observational study was conducted in the Department of General Medicine, Silchar Medical College for a period of one year from 1st June 2015 to 31st May 2016 on 50 COPD patients.

Clinically stable patients with post-bronchodilator Forced expiratory volume in 1st second/Forced vital capacity ratio (FEV_1/FVC) < 0.7 on spirometry without any history of exacerbation over the preceding 6 weeks and willing to give written and informed consent to participate were included in the study. All patients with unstable coronary artery disease, history of congestive heart failure, significant pulmonary disease other than COPD, significant orthopedic or neurological disease, renal, hepatic, or other medical disease were excluded f rom the study. Further patients having drop in saturation to < 90% on 6-minute walk test, patient on long-term oxygen therapy and those who were unable to perform 6 minute walk test (6-MWT) and Spirometry were also excluded.

All patients were subjected to full history and clinical examination. All data were collected by predesigned structured proforma from the patients and/or attendants after fulfillment of inclusion and exclusion criteria. Written and informed consent was taken from all the patients for participation in the study which was approved by the Ethical Committee of Silchar Medical College and Hospital, Silchar, Assam. A Schiller Spirovit SP1 Spirometer (serial no.540.10713, made in Switzerland, SCHILLER AG ALTGASSE 68 CH-6341 BAAR SWITZERLAND) was used for pulmonary function testing. All cases were subjected for pulmonary function test using spirometric evaluation of:-

- Forced expiratory volume in one second (FEV_1) in litres.
- Forced Vital Capacity (FVC) in litres.
- Ratio of FEV_1/FVC

Body mass index (kg/m^2) was calculated in each subject. Dyspnea severity was classified using the modified Medical Research Council (mMRC) dyspnea scale (Bestall, 1999) while exercise capacity was assessed by 6 minute walk test. The 6 minute walk test was performed as per the American Thoracic Society Guidelines in a 30 metre long and 4 metre wide hospital corridor. Patients were instructed to walk as fast as possible, aiming to complete the longest possible distance in 6 minute. At each full minute during the test, the patients were verbally encouraged with a standardized incentive phrase (American Thoracic Society, 2002). The Bengali and English version of COPD assessment test (CAT) was administered to all subjects. Each item was scored from 0 to 5 resulting in a total score ranging from 0 to 40, corresponding to the best and worst health status in patients with COPD. The questionnaire is designed to elicit a patient's own opinion about his/her health. Patients were requested to complete the questionnaire themselves without assistance, as correctly and as completely as they could and it was stressed that there were no right or wrong answers. Missing data was recorded as such (Jones, 2009).

All patients were then classified in the BODE multidimensional grading system and four COPD categories according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines.

Statistical Methods The data were entered and calculated using the SPSS for Windows version 17.0 software package (SPSS Inc, Chicago, Illinois, USA).The data collected on various aspects of the study were compiled, tabulated, subjected to statistical analysis in the forms of mean, standard deviation, minimal and maximum values for quantitative variables and number and percentage for qualitative values.

The correlations of CAT Score with BODE Index were determined using Pearson correlation coefficient analysis. The following cut-offs parameters were used: 0<| r |<0.3 = weak correlation; 0.3<| r |<0.7 = moderate correlation; | r | >0.7 = strong correlation (Gerstman, 2008) Statistical differences between groups were tested using ANOVA (analysis of variance) for quantitative normally distributed variables. P-values less than or equal to 0.05 were considered statistically significant.

RESULTS AND OBSERVATIONS:

The study included 50 patients with 68% predominantly from rural areas and rest 32% from urban areas. Out of 50 patients, 44(88%) were males and 6(12%) female candidates with male: female ratio of 7.33:1. 34% of the patients (17 patients) were farmer by occupation. Patients selected in the study were in the age group ranging from 45 to 81 years with majority in the age group of 61-70 years (44%). Mean age of the study population was 62.56 ± 8 years with a mean body mass index of 20.21±2.59 kg/m^2. Among 50 patients, 46% were current smokers, 40% ex-smokers and 14% were never smokers. Mean pack years of smoking and mean duration of illness was 27.03 ± 16.8 years and 7.28 ± 3 years respectively. Among the spirometric parameters, mean FEV_1 % predicted, mean tested FVC, mean tested FEV_1 and FEV1/FVC(%) were respectively 49.92 ± 16.95%, 1.85 ± 0.57 litres, 1.093 ± 0.39 litres and 59.05 ± 9.89%. The number of individuals scoring Grade 1, 2, 3, 4 on the modified Medical Research Council Breathlessness Scale were 4(8%), 14(28%), 28(56%) and 4(8%) respectively.

In the present study maximum number of patients belonged to GOLD 2 category(48%) followed by GOLD 3 (38%), GOLD 4(10%) and GOLD 1(4%) respectively. Mean CAT score was 21.12 ± 4.88 while GOLD category wise mean CAT scores were 14.5 ± 0.7 (GOLD 1), 18.04 ± 3.17(GOLD 2), 23.58 ± 2.83 (GOLD 3) and 29.2 ± 3.27 (GOLD 4). Difference in mean CAT scores between different GOLD categories was statistically significant as calculated by ANOVA (f=28.22, p<0.00001). The CAT score was classified into four groups of low impact (0 patients-0%), medium impact (23 patients-46%), high impact (26 patients-52%) and very high impact (1 patient-2%) based on the impact level of disease on health status. Mean 6 minute walk distance was 223.3 ± 60.67 metres and the mean mMRC scale of the study group in different GOLD categories were 2.5 ± 0.71 (GOLD 1), 2.33 ± 0.76 (GOLD 2), 3 ± 0.47 (GOLD 3) and 3 ± 1 (GOLD 4) respectively. Mean calculated BODE index was 5.96 ± 2.05. Patients were then classified into BODE 1 (score 0-2), BODE 2 (score3-4), BODE 3 (score 5-6) and BODE 4 (score 7-10) where there were respectively 5 (10%), 9 (18%), 16 (32%) and 20 (40%) patients. CAT score of each patient was then correlated by Pearson's correlation coefficient with the BODE index which revealed significantly strong positive correlation between CAT score and BODE index (r=0.7007, p<0.00001).

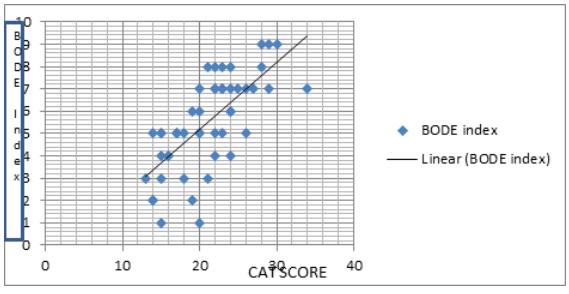


Fig 1:- CORRELATION OF CAT SCORE AND BODE INDEX

Table showing CAT impact Level

CAT impact level	Low<10 n=0	Medium(10-20) n=23 (46%)	High (21-30) n=26(52%)	Very high>30, n=1(2%)
Mean CAT	-	16.82	23.61	34

Table showing Characteristics of patients with COPD included in the study (n=50)

CHARACTERISTICS	Mean + SD
Age(years)	*62.56 + 8*
Male/ Female (n / %)	*44/06 (88%/12%)*
Dwelling place (Rural/Urban- n/%)	*34/16 (68%/32%)*
Smoking History (pack years)	*27.03 + 16.8*
Duration of illness (years)	*7.28 + 3*
Body Mass Index, kg/m2	*20.21 ± 2.53*
mMRC dyspnea score 0,1,2,3,4 (%)	*0%,8%,26%,58%,8%*
GOLD Stage I, II, III, IV [n, (%)]	*2, 24, 19, 5 (4%, 48%, 38%, 10%)*
BODE Index quartile 1, 2, 3, 4[n, (%)]	*5, 9, 16, 20 (10%, 18%, 32%, 40%)*
FEV1% predicted	*49.92 ± 16.95 %*
6 Minute Walk Distance (metres)	*223.3 ± 60.67*
CAT score	*21.12 ± 4.88*
BODE Index	*5.96 ± 2.05*

mMRC-modified Medical Research Council; GOLD-Global Initiative for Obstructive Lung Disease; FEV1-Forced Expiratory Volume in 1st second; CAT-COPD Assessment Test

DISCUSSION

COPD represents an important public health challenge that is both preventable and treatable. India is experiencing a continued increase in the burden of COPD. Multiple extra-pulmonary systemic effects and consequences leading to co morbid conditions like skeletal muscle wasting, osteoporosis, cardiovascular disease, diabetes mellitus, gastro-esophageal reflux disorder and depression may exist in addition to the respiratory compromise found in a patient with COPD which necessitates a detailed assessment and staging of the disease beyond the assessment of degree of airflow limitation alone. The impact of COPD in an individual patient depends not just on the degree of airflow limitation but also on the severity of symptoms and complications of the disease as well as frequency of acute exacerbations of COPD. Though the criterion of airflow limitation is used to define COPD, in practice the decision to seek medical help is determined normally by the impact of a particular symptom on a patient's lifestyle and quality of life which explains the necessity of a good questionnaire in assessing disease severity. The CAT score is effective in evaluating the quality of life in COPD patients as well as improving patient-physician communication.

The maximum numbers of COPD patients (22 out of 50) in this study were in the age group of 61-70 years probably because of the longer duration of tobacco exposure. The mean age of the study group was 62.56 ± 8 years which is consistent with other similar studies conducted by Santos *et al* (mean age 66.6±12.0 years*)*[Santos,2013], Tripathi *et al* (mean age 61.52±6.4 years*)* [Tripathi 2017] , Choudhury *et al* (mean age 60.3 ±9.9 years) [Choudhury, 2016]. Regarding the sex distribution, males form 88% (44 out of 50 cases) and females 12% (6 out of 50 cases) of the study subjects. Similar findings were observed by related studies like Sarkar *et al* [Sarkar, 2015] and Liu *et al* [Liu, 2012]. The higher incidence in males can be attributed to maximum number of studied population belonging to advanced age and higher number of males engaging in tobacco smoking as compared to females. Mean CAT score in the present study was 21.12 ± 4.88 which is in concordance with the previous researches done by Tripathi et al (mean CAT score 21.10±5.3) [Tripathi, 2017], Ghobadi et al (mean CAT score 19.61±8.07) (Ghobadi, 2012) and Gologanu et al (mean CAT score 18.3±8.2) [Gologanu, 2014]. Majority (almost 98%) patients belonged to medium to high impact CAT grading. Whereas mean BODE index in the present study was 5.96 ± 2.05 which is comparable to previous studies like Ladeira et al (2.8±1.8) [Ladeira, 2015] and Anami et al (3.94±1.95) [Anami, 2011]. Regarding the correlation of CAT score and BODE Index which was the main subject of interest in the present study, it was observed that there was a significant strongly positive correlation between these two variables ($r=0.7007$, $p<0.00001$) which is consistent with previous literatures like Ladeira et al($r=0.475$, $p<0.01$) [Ladeira, 2015], Akor et al($r=0.74$, $p<0.00001$) [Akor, 2015], Santos et al($r=0.26$, $p=0.149$) [Santos, 2013] and Tripathi et al($r=0.578$, $p<0.001$) [Tripathi, 2017]

Conclusion: - CAT questionnaire is a patient completed multi-linguistic set of questions which proves as a reliable and sensitive test in estimating the wide spectrum of the impact of COPD on health status. Due to its availability in various languages it can be easily applied to broad range of population. It has got a significantly strong positive correlation with BODE Index in stable COPD pa**tients in the present study which highlights the importance of CAT scoring in** primary rural health care settings where appropriate tools for assessing BODE index may not always be available and in those cases CAT can be used for easier detection of COPD health status and the disease impact.

Limitations:-

(1) Sample size was small, i.e. only 50.
(2) It was a hospital based study. Only symptomatic patients were included in the study.
(3) Though CAT score is a very reliable test, one of the drawbacks is that sometimes the scoring may differ due to unequal perception of the same level of symptoms by different patients as different.

Conflict of Interest: - None.

Source of support: - Self funding.

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