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Correlation of FEV1/FEV6 with BODE Index, CAT Score and DLCO in COPD Patients

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ABSTRACT

Chronic Obstructive Pulmonary Disease is associated with progressive airflow limitation. Spirometry is one of the most important non-invasive tests that help in diagnosing airway obstruction. A Post bronchodilator FEV1/FVC ratio < 0.7 according to GOLD guidelines is considered to be diagnostic of COPD, wherein FEV1 is the forced expiratory volume in the first second, and FVC is the forced vital capacity which requires complete emptying of lungs that may require longer expiratory time and a more significant expiratory effort. The value of FEV1/FEV6 ratio is similar to the FEV1/FVC rate in diagnosing obstruction. FEV1/FEV6 is one such spirometric measurement which reduces the effort of expiration and helps in detecting the airway obstruction at the end of the sixth second during forceful exhalation thus serving as a natural, cost-effective bedside investigation that can be used in every health care facility for prompt diagnosis and management of the disease. FEV1/FEV6 can also be used to assess the prognosis of patients with COPD. It can even independently predict the reduction of lung function, rate of death and risk of carcinoma. The vitalograph is a smooth handheld device which helps in early detection of COPD in a quick, simple and reproducible manner. It not only displays the FEV1, FEV6 ratio and FEV1 per cent predicted but also provided information regarding the severity of COPD classification and lung age estimation. It can be used as a tool to avoid over diagnosis of COPD, especially in elderly patients. It has the advantage of requiring minimal instruction for use by non-respiratory specialists as well. This work concludes that FEV1/FEV6 can be used as a simple, cost-effective bedside investigation to diagnose COPD as an alternative to the conventional spirometry to detect undiagnosed airway obstruction in individuals with a low expiratory effort, especially in poor resource settings.

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INTRODUCTION

In this segment represents the introduction of this research work. Chronic obstructive pulmonary disease (COPD) is ranked 3rd in causing death all over the world and 9th most significant cause of life years lost. It is considered to be a significant public health issue since of increasing prevalence and mortality. [1] [2] [3]The primary feature of COPD is the limitation of the airflow. Hence, spirometry is an essential tool for diagnosing and assessing its severity. Many parameters are used in pre-

dicting the degree of airflow limitation. [4] [5]The GOLD guidelines for evaluating the severity of COPD, not only consider airflow limitation but also involves assessing the common signs and exacerbation history. [6] [7]

The standard gold method to diagnose airflow limitation is calculated by using FEV1/FVC (Forced expiratory volume at first second/forced vital capacity), with FEV1 assessing the severity. Spirometry necessitates a longer duration of expiration and FVC is subtle to expiratory time. [8] [9]

FEV6 is simple and easily reproducible when compared to FVC, with less discomfort to the patient. The value of FEV1/FEV6 ratio is similar to the FEV1/FVC rate in diagnosing obstruction. [10]

FEV1/FEV6 is one such spirometric measurement which reduces the effort of expiration and helps in detecting the airway obstruction at the end of the sixth second during forceful exhalation thus serving as an easy, cost-effective bedside investigation that can be used in every health care facility for prompt diagnosis and management of the disease. [11] [12]

FEV1/FEV6 can also be used to assess the prognosis of patients with COPD. It can even independently predict the reduction of lung function, rate of death and risk of carcinoma. [13]

The vitalograph is a natural handheld device which helps in early detection of COPD in a quick, simple and reproducible manner. [14] It not only displays the FEV1, FEV6 ratio and FEV1 per cent predicted but also provided information regarding the severity of COPD classification and lung age estimation. [15] It can be used as a tool to avoid over diagnosis of COPD, especially in elderly patients. [16]It has the advantage of requiring minimal instruction for use by non-respiratory specialists as well.

Though there are many studies which show the correlation of FEV1/FVC with morbidity indices like BODE index, and symptom assessment questionnaires like CAT score there are minimal studies which have assessed the correlation of FEV1/FEV6 with symptom assessment scores and other indices. [17] [18] Hence, this study aims to correlate FEV1/FEV6 which is a simple tool in detecting airway obstruction and comparing it with parameters like BODE Index, CAT score and DLCO and PAH. [19] [20]

In this articles represents sector 2 of this articles explains the feature on the related works. In section 3 presents the materials and methods adopted and section 4 presents the particulars of the experimentations and discussions. Finally, segment 5 accomplishes the articles by allocation our implications and upcoming strategies.

RELATED WORKS

In this segment represents emphases the related works of this research work.COPD is a common treatable and preventable disease that is categorized by determined respiratory signs and airflow restraint that is due to airway and alveolar abnormalities typically caused by significant exposure to noxious particles or gases. [21] [22]Chronic airway inflammation narrows the small airways (chronic bronchiolitis) and destroys the parenchyma of the lungs (emphysema). This, in turn, results in a reduction in recall capacity of the lungs, thereby failing to keep the airways patent at the time of expiration. [23] [24]COPD is seen in smokers with a longer duration and hence it can be associated with increased risk for morbid conditions which include angina, myocardial infarction, respiratory infections, depression, diabetes, osteoporosis, sleep disturbances and anaemia. [25] [26] Up to 25% of the population who are more than 65 years old have two comorbid conditions while 17 per cent have up to 3 according to Data collected from the Netherlands.

The attendance of COPD increases the risk of carcinoma lung with the reason for the association not being apparent. Therefore, it is essential to carry out a combined evaluation of airflow limitation and associated comorbidities.

COPD continues to progress with the increased exposure to harmful substances and can show improvement in the abnormal functioning once the vulnerability is halted. Thus treating COPD improves the day to day activities and causes a reduction in symptoms, exacerbation and mortality. [27]

Spirometry is important for diagnosing the severity of airflow limitation and also to quantify the pathology. The post bronchodilation FEV1/FVC ratio of less than 0.7 is considered to diagnose airway obstruction. At the same time, FEV1% predicted it helps in classifying the disease severity according to certain studies, although these cut off values are not validated clinically. [28]

The risk factors for COPD development have to be identified for initiating early treatment and preventing further progression of the disease. [29] Burning is considered to be the predominant risk factor, and cessation of smoking is a critical awareness that contributes to preventing as well as decrease the progressive nature of COPD. [30]However, apart from smokers, chronic airflow obstruction is also seen in

nonsmokers. Not many studies were able to monitor the course of the disease completely, and hence more studies are required to assess the importance of risk factors.

MATERIALS AND METHODS

In this segment represents the materials and methods of this research work. The study was shown in the department of Respiratory Medicine.100 COPD patients diagnosed with COPD using GOLD guidelines(FEV1/FVC< 70) were included in the study, and their demographic data, detailed clinical history was obtained. Their FEV1/FEV6 ratio was calculated using Vitalograph(model 4000) and best out of the three values obtained were included in the study. Their BODE index was obtained by calculating BMI using the formula wgt(in kgs)divided by height(meters square), Obstruction(FEV1 %predicted), Dyspnoea by MMRC grading and Exercise tolerance by six minutes walk test.DLCO per cent predicted values were taken; CAT score was calculated using the questionnaire which was provided to the patient2D ECHO to estimate the presence and severity of PAH was done.

RESULT AND DISCUSSION

In this segment focuses on the results and discussions of this research work. As seen in the above table, most of the study population belongs to the age group between 51 to 60 years (42%) with a mean age of 57.13 $\pm$ 8.318.

Table 1: Age distribution amongst the COPD patients (N = 100)

Age group	Frequency
40 – 50 Years	29
51 – 60 Years	42
61 – 70 Years	25
71 – 78 Years	4
Total	100

As seen in the above table, the majority were **males (63%)** The study population showed a majority of the COPD patients above 51 years of age with a mean age of 57.13 $\pm$ 8.318 showing a male preponderance 63%)and businessmen (28%)being at high risk for COPD.70% were smokers, and 30% were nonsmokers. Out of the 70 smokers, 34.28% were current smokers, 41.42% were ex-smokers, 24.28% were passive smokers were in 23.52% were males, and 76.47% were females. There were no female current and ex-smokers. Out of the 30 nonsmokers,15% were exposed to biomass fuel exposure with all of them being females. The mean BMI was 22.61$\pm$ 3.643, with the majority having a healthy BMI(74%). Majority of them had grade 2 to grade 3 dyspnoea according to MMRC.

The mean FEV1/FEV6 was 0.80$\pm$ 0.314, and mean FEV6 was 2.06$\pm$ 0.422. The mean CAT score was 20.00$\pm$ 5.507 and majority(50%)had a score between 10 – 20. About 47.14% of smokers had a CAT score above 20. Patients exposed to biomass fuel (66,66%) had a score between 10 - 20. Majority of the patients (85%) had a six-minute walk distance between 150MTS – 349 MTS with a mean of 258.90$\pm$ 59.132. About 87% of smokers had a six-minute walk distance between 150 – 349 MTS. 66.66% of patients exposed to biomass fuel had a six-minute walk distance between 150– 249 MTS. BODE INDEX score was between 3-4 in the majority of the patients(31%) with 4.90$\pm$ 1.987 being the mean index.28.5% of smokers had a BODE index 7,40% of patients with biomass fuel exposure had abode INDEX between 3-4. There was a moderate decrease in DLCO%(between 40-60%) in most of the patients(35%) with a mean of 58.72$\pm$ 12.912. Majority of the smokers(37.14%) and patients exposed to biomass fuel(33.33%)showed a mild decrease in DLCO%(> 60 - < 75%). Majority of the patients had mild to moderate PAH.

Correlation between FEV1/FEV6 measured by vitalograph and FEV1/FVC calculated by spirometry showed a positive correlation with the significance of 0.033indicating that FEV1/FEV6 can be used as an alternative to FEV1/FVC. FEV1/FEV6, when correlated with BODE index, CAT score and PAH showed a negative correlation with a significance of 0.000. There was a significant positive correlation between FEV1/FEV6 and six-minute walk test(6 MIN walk test) with a significance of 0.000. There was a significant negative correlation between FEV1/FEV6 and MMRC grading with a significance of 0.000. There was a significant negative correlation between FEV1/FEV6 and passive smoking with a significance of 0.000 There was a positive correlation between female passive smoking BODE index,(significance of 0.005)and CAT score(0.0007). There was no significant correlation between FEV1/FEV6 and DLCO%. No significant association was found in between smokers, biomass fuel exposure and BODE index, CAT score, DLCO%, MMRC grading, six-minute walk test(6MIN walk test). There was no significant correlation between smokers, biomass fuel exposure with PAH (Table 1).

Therefore, the study suggests that FEV1/FEV6 can

be used as an alternative to FEV1/FVC. A decrease in lung function as measured by FEV1/FEV6 was associated with a significant increase in BODE index, CAT score, PAH, MMRC grading and a substantial decrease in the exercise capacity(six-minute walk test). There was a significant positive association between passive smoking, BODE index and CAT score while a significant negative association was observed between passive smoking and decrease in lung function.

CONCLUSIONS

Finally, this work concludes that FEV1/FEV6 can be used as a simple, cost-effective bedside investigation to diagnose COPD as an alternative to the conventional spirometry to detect undiagnosed airway obstruction in individuals with a low expiratory effort, especially in poor resource settings. In this study as FEV1/FEV6 showed a negative correlation with BODE index, CAT score and PAH it can be considered as a reliable tool for symptom assessment and for evaluating the presence and severity of PAH in COPD patients.

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Conflict of Interest

Authors declared no conflict of interest.

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