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Physiology

DETECTION OF EFFICIENCY OF LUNG FUNCTIONS IN COPD PATIENTS VIA SPIROMETRY IN WESTERN RAJASTHAN

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ABSTRACT **INTRODUCTION:** Chronic obstructive pulmonary disease (COPD) is one of the most common respiratory diseases which is associated with anæmia, systemic inflammation, weight loss, skeletal muscle dysfunction, cardiovascular disease and osteoporosis etc. It is necessary to reassess the efficacy of predictors of prognosis in COPD patients. As we know the earlier that COPD is diagnosed, the better the long-term prognosis. **MATERIAL AND METHOD:** The study was conducted on 50 normal healthy subjects which were chosen on random basis from society that served as control group and 150 non-tubercular Chronic Obstructive Pulmonary Disease (COPD) patients which served as test group were undergone following investigations as per standard methods:-Pulmonary function tests: including Respiratory parameters like FVC, FEV-1, FEV-1/FVC Ratio, FEF 25-75%, PEFR were determined by Computerized Spirometer MEDISPIRER. **CONCLUSION:** Our study suggests significant lowering in all PFT values especially FEV -1 in both moderate and severe COPD patients. Although this decrease in moderate COPD patients were less as compared to severe COPD patients. This clearly indicates the importance of spirometry as a tool and FEV -1 as a parameter in assessing the severity of the disease.

KEYWORDS : COPD; Spirometry

INTRODUCTION:

Chronic obstructive pulmonary disease (COPD) represents one of the most common respiratory diseases in clinical practice. Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality throughout the world. Many people suffer from this disease for years and die prematurely of it or its complications. The current definition of COPD, established by the Global Initiative on Chronic Obstructive Lung Disease (GOLD) and recently adopted, in large part, by the American Thoracic Society (ATS) and the European Respiratory Society (ERS), states COPD as "a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases."[14] Three pathologic processes play a significant role in COPD-related lung damage: (1) oxidative stress, (2) inflammation, and (3) an imbalance in enzymes (e.g., proteases) involved in cell injury and repair. The predominant risk factor for COPD in the developed world is cigarette smoking.[1,2] Other factors may also be important in some individuals, including occupational or environmental exposures to dusts, gases, vapours or fumes,[3] exposure to biomass smoke,[4] malnutrition,[5] early-life infections,[6] genetic predisposition,[7-9] increased airways responsiveness,[10,11] and asthma.[12,13] COPD is a leading cause of death and disability worldwide. It is largely preventable but is expensive to treat.[194] The World Bank estimates that COPD is responsible for 29 million disability-adjusted life-years and 1 million years of life lost per annum around the world. These figures place COPD as the fifth most significant global health problem, and COPD is expected to become the third leading cause of death in the first quarter of the next century. Furthermore, COPD is currently the 12th leading cause of disability worldwide and is expected to be the fifth leading cause of disability by 2020.[15] $FEV_1\%$ predicted is the most important predictor of future clinical COPD outcomes adding to the prognostic value of FEV_1 in predicting COPD. This corroborates with the idea that airflow limitation and airway inflammation are separate and independent factors in the patho physiology of COPD,[16] Looking to the fact that chronic obstructive pulmonary disease (COPD) is one of the most common respiratory diseases which is associated with anæmia, systemic inflammation, weight loss, skeletal muscle dysfunction, cardiovascular disease and osteoporosis etc. Therefore we thought it necessary to reassess the efficacy of predictors of prognosis in COPD patients in the local population of Jodhpur City. Over the years, physicians have done much to help us understand the causes, diagnosis, and progression of COPD. The earlier that COPD is diagnosed, the better the long-term prognosis.

MATERIAL AND METHOD:

The present study was conducted under the Department of Physiology, Dr. S. N. Medical College, Jodhpur and LN Rathi memorial Hospital, Jodhpur. 50 normal healthy subjects were chosen on random basis from society which served as control group. 150 non-tubercular Chronic Obstructive Pulmonary Disease (COPD) patients attending OPD/indoor at Rathi Hospital, Jodhpur were included in this study and labelled as test group. Patients of test group were undergone following investigations as per standard methods described in detail in following paragraphs.:-Pulmonary function tests: Respiratory parameters like FVC, FEV-1, FEV-1/FVC Ratio, FEF 25-75%, PEFR were determined by Computerized Spirometer MEDISPIRER. **Spirometry** The most common test used in helping to diagnose the condition of lung is called spirometry. This test estimates lung volumes by measuring how much air you can blow out into a machine. Two results are important: 1. The amount of air that can be blown out in one second (called forced expiratory volume in 1 second - FEV1) 2.The total amount that can be blown out in one breath (called forced vital capacity - FVC). Your age, height and sex affect your lung volumes. So, *your* results are compared to the average predicted for your age, height and sex. A value is calculated from the amount of air that you can blow out in one second divided by the total amount of air that you blow out in one breath (called FEV-1/FVC ratio). A low value indicates that you have narrowed airways. The FEV-1 compared with the predicted value shows how bad the COPD is. But while attending outdoor department of hospital, we observed that mildly effected patients were usually not sincere about their disease and rarely regularly consult pulmonologist and very severe patients are not in a position to be subjected to PFT tests. Therefore we studied only two groups i.e. Moderate & Severe COPD patients.

PULMONARY FUNCTION TESTS -

Respiratory parameters like FVC, FEV-1, FEV-1/FVC Ratio, FEF 25-75%, PEFR were determined by Computerized Spirometer MEDISPIRER according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria.[17] As per spirometric results of FEV-1, test group patients can be divided into four groups viz. Mild, Moderate, Severe & very Severe COPD. A criterion for

classifying COPD patients is FEV-1. **:1.** Mild (stage 1) COPD is an FEV1 at least 80% of predicted value. **2.** Moderate (stage 2) COPD is an FEV1 between 50% and 79% of predicted value. **3.**Severe (stage 3) COPD is an FEV1 between 30% and 49% of predicted value.

OBSERVATION AND RESULT
Table 1 Changes in PFT Parameters in Moderate COPD Patients [n = 97] v/s Controls [n = 50]

Subject	FVC [% Pred]	FEV 1 [% Pred]	FEV 1/FVC [% Pred]	FEF 25-75% [% Pred]	PEFR [% Pred]
Control	77.14±4.25	68.06±5.97	93.46±7.50	83.52±8.3	78.09±5.49
COPD	63.62±3.94	53.26±2.80	85.31±7.3	49.02±8.73	47.38±9.0
p-value	0.0000001	0.0000001	0.0000001	0.0000001	0.0000001

Graph 1 - Variations in PFT Parameters In Moderate COPD Patients [n=97] v/s Controls [n=50]
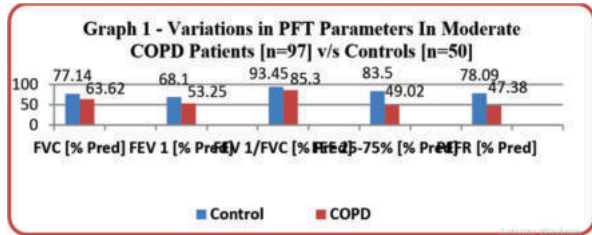
Table & Graph 1 shows changes in various PFT parameters in moderate COPD patients in comparison to control PFT values. All PFT parameters shown in this table are in % predicted values. All values i.e FVC, FEV1, FEV1/FVC, FEF 25-75% and PEFR values were found to be highly significant respectively.

Table 2 - Changes in PFT Parameters in Severe COPD Patients [n = 53] v/s Controls [n = 50]

Subject	FVC [% Pred]	FEV 1 [% Pred]	FEV 1/FVC [% Pred]	FEF 25-75% [% Pred]	PEFR [% Pred]
Control	77.14±4.25	68.06±5.97	93.46±7.50	83.52±8.30	78.09±5.49
COPD	61.07±3.7	47.32±2.63	76.64±6.05	43.32±8.18	42.99±8.85
p-value	0.00017	0.0000001	0.0000001	0.00009	0.0047

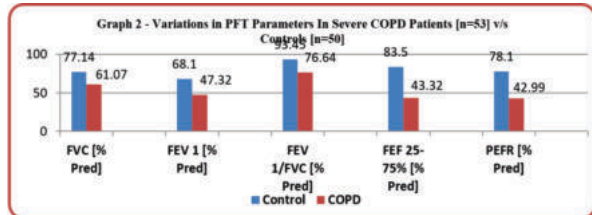Graph 2 - Variations in PFT Parameters In Severe COPD Patients [n=53] v/s Controls [n=50]

Table & Graph 2 shows changes in various PFT parameters in severe COPD patients in comparison to control PFT values. All PFT parameters shown in this table are in % predicted values. FVC values were found to be highly significant. Similarly FEV1, FEV1/FVC, FEF 25-75% and PEFR values were also found to be highly significant respectively.

Table 3 - Comparison of PFT Changes in Moderate COPD Patients [n = 97] v/s Severe COPD Patients [n = 53]

Subjects	FVC [% Pred]	FEV 1 [% Pred]	FEV 1/FVC [% Pred]	FEF 25-75% [% Pred]	PEFR [% Pred]
Moderate	63.62±3.94	53.26±2.8	85.31±7.3	49.02±8.73	47.38±9.0
Severe	61.07±3.7	47.32±2.63	76.64±6.05	43.32±8.18	42.99±8.85

Graph 3 - Comparison Between Variations In PFT Parameters In Moderate [n=97] And Severe COPD Patients [n=53]
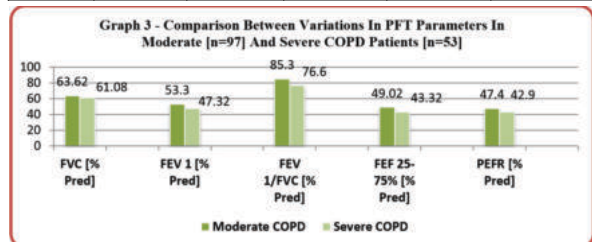
Table & Graph 3 shows changes in various PFT parameters in moderate COPD patients in comparison to severe PFT values. All PFT parameters shown in this table are in % predicted values. All the p-values FVC, FEV1, FEV1/FVC, FEF 25-75% and PEFR were found to be highly significant.

DISCUSSION
Our study suggests significant lowering in all PFT values especially FEV -1 in both moderate and severe COPD patients. Although this decrease in moderate COPD patients were less as compared to severe COPD patients. This clearly indicates the importance of spirometry as a tool and FEV -1 as a parameter in assessing the severity of the disease. Mannino and coworkers[18] evaluated obstructive lung disease deaths in the United States from 1979 through 1993, and found that 2.5 million (8.2%) individuals had the diagnosis of COPD listed on their death certificate. Of these, 1.1 million (43.3%) had COPD listed as a cause of death. Davood Attaran et al[19] studied 115 patients of COPD. Out of the total enrolled patients in their study, they reported following findings:- 80 were eligible for analysis (53 males and 27 females, mean age of 66.48±11.55 years and FEV1, 1.04±0.39 lit, and 45.14±16.88 % predicted.). There was a history of smoking in 76 patients (95%).

Grading of disease severity revealed that 6 patients (7.5%) had mild, 18(22.5%) had moderate, another 18 had (22.5%) severe, and 38 patients (47.5%) had very severe COPD. Kim and colleagues[20] report on the prevalence of COPD in Korea using data from the 2nd Korean National Health and Nutritional Examination Survey, which had adequate spirometry data from 3,981 subjects(43.1% of the 9,243 subjects sampled). They used a modification of the Global Initiative on Obstructive Lung Disease (GOLD) criteria to classify subjects. Their main criteria for the presence of COPD were an FEV_1/FVC of less than 0.70, corresponding to GOLD Stage 1 or more severe COPD. Overall, they found that 7.8% of the studied population had GOLD Stage 1 or more severe COPD. COPD is a growing cause of morbidity and mortality that crosses borders and cultures. The first step in dealing with any disease is to determine how common it is in the population and to target prevention strategies toward both decreasing risk factors for disease development and earlier detection of disease when it is more treatable. COPD is very difficult to diagnose and detect clinically in its milder forms without the use of spirometry. Unfortunately, spirometry is not routinely employed in patients at risk for developing COPD (ie, smokers), and spirometric test results are not routinely recorded or consistently interpreted. This is due, in part, to the gradual and insidious development of airflow obstruction in COPD and, in part, to absent or nonspecific symptoms that may occur in patients with mild forms of the disease.[21-23] As a result of the large reserves in human lung function and the fact that COPD is a slowly progressive disease, the clinical diagnosis of COPD is often delayed until extensive and irreparable damage has occurred. Smoking rates appear to provide a useful method of estimating total COPD prevalence, not just the total number of people with diagnosed disease.

CONCLUSION
COPD is very difficult to diagnose and detect clinically in its milder forms without the use of spirometry. Unfortunately, spirometry is not routinely employed in patients at risk for developing COPD (ie, smokers), and spirometric test results are not routinely recorded or consistently interpreted. As a result of the large reserves in human lung function and the fact that COPD is a slowly progressive disease, the clinical diagnosis of COPD is often delayed until extensive and irreparable damage has occurred.

As Lowering of PFT is the main criteria for diagnosing and classifying COPD, we recommend a more emphatic use of spirometry in early diagnosis of COPD.

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