Original Research Article

Study of diffusion capacity of lung for carbon monoxide (DLCO) in chronic obstructive pulmonary disease

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Abstract

Background: The most useful test of the gas exchange capacity of the lung that correlates with the total functioning surface area of alveolar capillary interface is the DLCO. **Aims and Objectives:** To Study Diffusing Capacity of Lung for Carbon Monoxide (DLCO) in Patients with COPD. **Material and Methods:** A study was done with 115 patients in the Department of Respiratory Medicine in a tertiary care centre. **Results:** Majority of the patients (39.9%) were in the age group of 61-70 years with male pre-ponderance(71.3%). It was observed that 50.4% patients had COPD Gold Grade III followed by 26.1% patients were COPD Gold Grade II, 20.9% patients with COPD Gold Grade IV and 2.6% with COPD Gold Grade I. Majority of the patients (18.8%) had ≥20 pack-year history and DLCO 40-60%. **Conclusion:** We concluded that as the COPD severity advances there was significant decline in DLco.
Key Words: COPD, Spirometry, DLco.

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality across the globe. According to World Health Organization estimates, 65 million people have moderate to severe COPD. More than 3 million people died of COPD in 2005 corresponding to 5% of all deaths globally and it is estimated to be the third leading cause of death by 2030 [1]. In India NCDs were estimated to have accounted for 53% of all deaths and 44% of disability-adjusted life-years (DALYs) lost in 2005. Of these chronic respiratory disease accounted for 7% deaths and 3% DALYs lost[2]. Crude estimates suggest there are 30 million COPD patients in India[3].India contributes a significant and growing percentage of COPD mortality which is estimated to be amongst the highest in the world; i.e. more than 64.7 estimated age standardized death rate per 100,000 amongst both sexes. This would translate to about 556,000 in case of India (>20%) out of a world total of 2,748,000 annually. The reported prevalence estimates have ranged from 2 to 22% in men and from 1.2 to 19% in women[4].Smoking is by far recognized to be the most important risk factor for development of COPD. Smoking behaviors in India are also peculiar with a large number of people using nonconventional form of tobacco in hookah, bidi, or chillum[5-6]. More than one-half of the world's households uses biomass fuels and a significant proportion of this activity takes place in conditions where much of the effluent is released into the indoor living area[7]. To evaluate the severity of chronic obstructive pulmonary disease (COPD), a number of measurements are required. These include spirometry, including forced expiratory

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volume during the first second (FEV1), forced vital capacity (FVC), and the ratio between these two measurements (FEV1/FVC)[8]. Spirometry measures are supplemented by evaluation of dyspnea using, for example, the modified Medical Research Council (mMRC) score[9] and considerations of the number of exacerbations in the preceding year. These figures allow stratification of the patient using the combined risk assessment score for COPD (GOLD score) as recommended by the Global Initiative for Chronic Obstructive Lung Disease (GOLD)[10]. The most useful test of the gas exchange capacity of the lung that also correlates with the total functioning surface area of alveolar capillary interface is the DLCO. Hence the present observational study is done to observe that DLco being a good additional parameter to conventional spirometry but not much has been studied according to the severity of COPD patients which will ultimately be useful in defining the Prognosis and treatment of the disease.

AIMS AND OBJECTIVES

1. To study Diffusing Capacity of Lung For Carbon Monoxide (DLCO) in Patients with Chronic Obstructive Pulmonary Disease
2. The correlation of DLCO with severity of airway obstruction according to GOLD guidelines.

MATERIAL AND METHODS

An institutional based **observational study** was undertaken with 115 patients in the Department of Respiratory Medicine in a tertiary care centre of a Medical College. The study duration was 1 ½ year. Considering the Prevalence of COPD as 7.7% with Absolute precession 5%, Power 80% calculated Sample Size was 115[11]. All Patients of Chronic Obstructive Pulmonary Disease according to GOLD (Global Initiative for chronic Obstructive Lung Diseases) Criteria visiting OPD/IPD of Dept of Respiratory Diseases of our tertiary centre were included in the study. All patients with Pulmonary Tuberculosis, patients with chest x-ray showing parenchymal lesion, patients with recent Myocardial Infarction, hemoptysis of unknown origin, patient with recent eye surgery were excluded from the study. The clinical symptom consisted of breathlessness. The enrolled patients were subjected to a protocol, which included detailed recording of history regarding mode of onset and duration of illness, complete physical examination, routine investigations like CBC, ESR, RBS, HIV, Hbs Ag, ECG and chest x ray.

OBSERVATIONS AND RESULTS

The mean age of the patients was 60.57±8.78 years. There was male preponderance (71.3%) in the study while 60% of patients were smokers while 40% patients were non-smokers. There was no significant association of DLCO with Smoking Pack Years as per Chi-Square test (p>0.05). There was no significant difference in the post vital capacity parameters of patients as per Student t-test **(p>0.05)** in relation to DLco(Table 1) and also no significant difference was found in post (MEF 25–75) parameters of patients as per Student t-test **(p>0.05)(Table 4).** There was significant difference seen in the post FEV1 parameters as per Student t-test **(p<0.05) (Table 2)** and post FEV1/FVC parameters of patients in relation to DLCO as per Student t-test **(p<0.05) (Table 3).** In the present study, higher Residual Volume (RV) and Residual Volume/Total Lung Capacity (RV/TLC) was observed.

Table 1: Post Vital Capacity Parameter of patients

	Post-Vital (Absolute)		P	Post-Vital (% predicted)		P
	Mean	SD		Mean	SD	
DLCO>60%	1.73	0.56	p>0.05	58.6	13.82	p>0.05
DLCO 40-60%	1.68	0.45	p>0.05	55.67	17.20	p>0.05
DLCO <40%	1.84	0.78	p>0.05	53.67	16.74	p>0.05

Table 2: % predicted FEV1 Parameter of patients

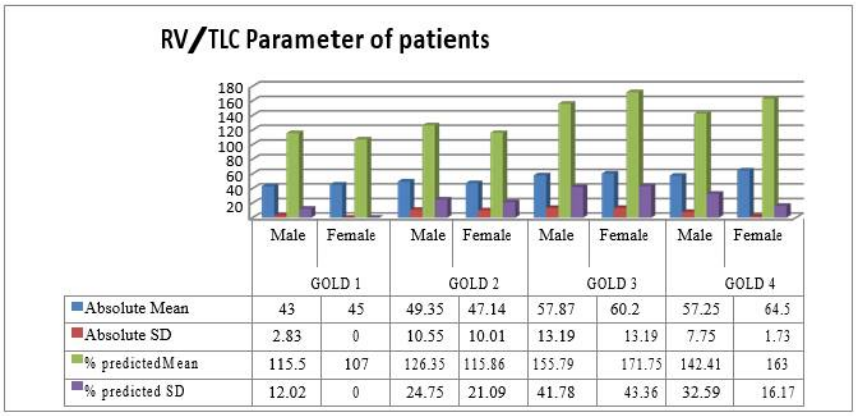
	Post FEV1 (% predicted)		p Value
	Mean	SD	
DLCO>60%	41	13.29	**p<0.05***
DLCO 40-60%	36.38	13.69	**p<0.05***
DLCO <40%	45.22	19.96	**p<0.05***

Table 3: Post FEV1/FVC Parameter of patients

	FEV1/FVC (Absolute)		p Value	FEV1/FVC (% predicted)		p Value
	Mean	SD		Mean	SD	
DLCO>60%	59.74	6.73	**p<0.05***	74	11.56	**p<0.05***
DLCO 40-60%	54.62	9.24	**p<0.05***	71.14	14.01	**p<0.05***
DLCO <40%	65.78	13.62	**p<0.05***	79.11	16.69	**p<0.05***

Table 4: Post MEF 25-75 Parameter of Patients

	MEF 25–75 (Absolute)		P Volume	MEF 25–75 (% predicted)		p Value
	Mean	SD		Mean	SD	
DLCO>60%	0.56	0.28	p>0.05	20.44	13.17	p>0.05
DLCO 40-60%	0.46	0.21	p>0.05	15.93	7.81	p>0.05
DLCO <40%	0.61	0.34	p>0.05	18.78	10.94	p>0.05



DISCUSSION

Majority of the patients (39.9%) were in the age group of 61-70 years. There was male preponderance (71.3%) in the study while female patients constituted 28.7% of the study group. 46.4% smokers had DLCO>60% while 39.1% and 14.5% patients had DLCO 40-60% and DLCO<40% respectively. 50% smokers had DLCO>60% while 32.6% and 17.4% patients had DLCO 40-60% and DLCO<40% respectively. There was no significant association of DLCO with Smoking habit as per Chi-Square test (p>0.05). Sansores RH *et al*[12] in a study to determine the acute effect of smoking on DLCO there was no significant change in DLCO or VC in six control subjects tested before and after 1 h of sham smoking of an unlit cigarette. In 12 control subjects studied before and after inhalation of 0.1% CO to result in mean COHb levels of 10.6% (SD, 1.4%), there was a slight but significant decrease in VC (mean change, 21%) and in DLCO (mean change, 4%) after correction for COHb back pressure and reduction in available hemoglobin, suggesting that CO inhalation may have a direct effect on DLCO by reducing VC. There was significant difference in the post FEV1 and FEV1/FVC in relation to DLCO while no significant difference was observed in MEF 25–75 parameters of patients. The studies of Brashier B *et al*[13], Jessica M *et al*[14], Fabbri LM *et al*[15] have demonstrated a significant positive correlation of FEV1% with DLCO in COPD patients. The DLCO values for various grades showed that as grade increases diffusion capacity decreases. In COPD patients, the decrease in DLCO is thought to be directly related to the loss of alveolar-capillary surface area that is associated with emphysema. In the present study, higher Residual Volume (RV) and Residual Volume/Total Lung Capacity (RV/TLC) was observed. The study of Sciurba FC16 observed that the higher RV in patients with airflow obstruction due to COPD suggests that parenchymal destruction is present in COPD.

CONCLUSION

We concluded that as the COPD severity advances there was significant decline in diffusion capacity for Carbon onoxide i.e DLco which contribute to the additional breathlessness. There is significant increase in residual

lung volume which hampers the alveolar ventilation and thus respiratory pump failure. Because of high cost and technical complexities DLco still difficult to use at community level.

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