PULMONARY FUNCTION TESTS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE WITH AND WITHOUT CARDIAC FAILURE

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A total of 95 mate subjects were included during the course of present study. 35 COPD without cardiac failure and 30 COPD with cardiac failure. Expiratory spirometry was performed on S- model vitalograph spirometer. Vital capacity (VC), forced vital capacity (VC), forced expiratory volume one second (FEV_1 expiratory ratio (FEV/FVC%) and forced expiratory flow 25-75% (FEF 25-75%) were performed on all subjects. The ventilatory functions of the male adult control of relevant age subgroups were found to decline with advancing age. Pulmonary function tests in COPD without and with cardiac failure were significantly decreased ($p<0.001$) when compared with controls. In the COPD without and with cardiac failure, the difference was statistically insignificant, h was even slightly higher in COPD with cardiac failure subjects except FEF 25-75%. These tests are therefore valuable for early diagnosis in COPD subjects but in COPD with cardiac failure their correlation with severity of lung disease is not perfect.

INTRODUCTION

The chronic non-neoplastic broncho-pulmonary disease poses a worldwide health challenge. Chronic obstructive pulmonary disease (COPD) comprises the majority of these illnesses.[1] COPD is the fourth leading cause of death in the United States, and there has been an increase in the death rate from this condition over the past 20 years.[2]

In most patients with severe COPD, if they live long enough, corpulmonale eventually develops.[1] Corpulmonale a heart disease secondary to disease of the lung is characterised by pulmonary hypertension, right ventricular hypertrophy and eventually right heart failure.' Therefore, it is concluded that pulmonary disease does not affect the heart directly but leads to pulmonary hypertension, which may cause right ventricular dilatation, hypertrophy and eventually failure.[4]

The spirometer was first introduced in to medicine by John Hutchinson, a surgeon, in 18462 Hutchinson predicted that the spirometer would be valuable in detecting persons who would be destined to premature morbidity and mortality, so the early detection of COPD subjects may offer the best chance to check and decrease the rising trend of mortality due to COPD. Spirometry is the mainstay of pulmonary function evaluation and the expiratory spirograms can assist in making the diagnosis of COPD.[1]

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MATERIALS AND METHODS

A total of 95 male subjects were included in this study, out of which 30 were clinically healthy controls and 65 patients. The patients suffering from COPD were selected on the basis of clinical history and the diagnosis made by the pulmonary function tests, the patients were divided into two groups, on the basis of echocardiography:

1. 35 COPD without cardiac failure.
2. 30 COPD with cardiac failure

All these subjects were classified on the basis of age in to three subgroups:

Subgroup A	age range	30-44
Subgroup B	age range	45-59
Subgroup C	age range	60-74

Expiratory spirometry was performed on S- model vitalograph spirometer. Vitalograph charts 6- second and disposable safety mouthpieces were used for recording the Spirograph. The purpose of test was explained to each subject and the method of testing was demonstrated. All tests were performed with the subjects in the standing position. In this study the system of nomenclature proposed by Gandavia and Hugh-Jones,[6] has been adapted.

Vital Capacity (VC)

Each subject was instructed to inspire maximally and fill lungs completely with air, then to hold the breath, keep mouthpiece in the mouth and close the lips tightly

around it and then to exhale smoothly and completely through the mouthpiece, without force and hustle until expiration is completed.

Vital capacity was read directly from the highest point on the vertical line, of the BTPS scale.

Forced Vital Capacity (FVC)

Each subject was instructed to inspire maximally and till lungs completely with air and then to exhale as rapidly, as forcibly and completely as possible and to sustain the expiration till the stylus reached the 6-second line on the chart. The procedure was repeated three times.[7] After observing the FVC curve, FEV^ FEV|/FVC% and FEF 25-75% were calculated by the help of percentage ruler and flow rate calculator.

RESULTS

Table-1 shows the mean values for VC in the three age subgroups. The values for VC of all three age subgroups of controls were highly significant (p<0.00l) when compared with the corresponding age subgroups of COPD without cardiac failure except for subgroup A. When compared with the corresponding age subgroups of COPD with cardiac failure, the mean values were highly significant (p<0.001).

Table-1: Vital Capacity (VC) in Different Age

Groups of Control and COPD Subjects.

GROUP	Age Subgroups (Years)		
	30-44 (A)	45-59 (B)	60-74 (C)
Control (n=30)	3.66+ 0.21 (11)	2.97+ 0.12 (10)	2.32+ 0.19(9)
COPD without cardiac failure (n=35)	3.08+ 0.46(10)	1.12**+ 0.09(14)	1.25**+ 0.17(11)
COPD with cardiac failure (n=30)	1.89**+ 0.31 (9)	0.97**+ 0.08 (10)	0.95**+ 0.08 (11)

*** p<0.00l as compared with group 1.*

Table-2 to 5 show the mean values of the other spirometric volumes. FVC, FEV_I FEV_I/FVC%, FEF 25-75% of controls were highly significant (p<0.001) when compared with COPD subjects without cardiac failure as well as COPD subjects with cardiac failure. The difference was however statically insignificant, when values of the three age subgroups of COPD subjects without cardiac failure were compared with that of COPD subjects with cardiac failure.

Table-6 show correlation of the mean values of pulmonary volume in controls and COPD subjects. Pulmonary volume of controls was highly significant (p<0.001) when compared with COPD subjects without and with cardiac failure. The difference was however statistically insignificant, even slightly higher except FEF 25-75% in cardiac failure when compared COPD without cardiac failure.

Table-2: Forced Vital Capacity (FVC) In Different Age Groups of Control and COPD Subjects

GROUPS	Age Subgroups (Years)		
	30-44 (A)	45-59 (B)	60-74 (C)
Control (30)	3.88+ 0.22(11)	3.24+ 0.12(10)	2.51 + 0.20 (9)
COPD without cardiac failure (35)	1.99** + 0.19(10)	1.41** + 0.12(14)	1.44**+ 0.17(11)
COPD with cardiac failure (30)	2.31**+ 0.33 (9)	1.28** + 0.14(10)	1.36**+ 0.13(11)

Table-5: Forced Expiratory Flow 25-75% (FEF 25-75%) in Different Age Groups of Control and COPI) Subjects

GROUP	Age Subgroups (Years)		
	30-44 (A)	45-59 (B)	60-74 (C)
Control (n=30)	3.91 ±0.3 4(11)	3.80+ 0.22 (10)	2.96+ 0.26 (9)
COPD without cardiac failure (n=35)	0 97**+o .16(10)	0.52**+0 .12(14)	0.46**+ 0.10(11)
COPD with cardiac failure (n=30)	0.89**+0 .13(9)	0.50**+0 .17(10)	0.36**+ 0.06 (11)

P< 0.001 as compared with group 1.

Table-6: Pulmonary Function Tests in Control and COPD Subjects

Tests	Control (n=30)	COPD without cardiac failure (n=35)	COPD with cardiac failure (n=30)
VC	2.98	1.81**	1.27**
FVC	3.21	1.61**	1.65**
FEV 1	2.58	0.97**	1.03**
FEV_I /FVC %	80.33	57.90**	60.16**
FEF 25-75%	3.55	0.65**	0.58**

P< 0.001 as compared with controls.

DISCUSSION

During the past 20 years the incidence of COPD has increased considerably and it has become the most prevalent chronic respiratory problem in even many developed countries of the World.[1,8] Vandenberg et al[9] showed that various tests can be employed to diagnose and assess the prognosis of COPD. Amongst those the most widely used tests have been the measurement of pulmonary functions. In this study the ventilatory functions of healthy male adult controls of relevant age subgroups were found to decline with advancing age even in the absence of respiratory disease, which is due to loss of elastic recoil of lungs and reduced chest wall compliance, these finding are in accordance with the Kory et al.[10]

In this study in all COPD subjects except subgroup A, VC and FVC were significantly- decreased (p<0.001) when compared with the controls but these tests are not reliable because these are also decreased in restrictive pattern and in other conditions.[511] In the present study in all COPD subjects, FEV, and $FEV_{|}$/FVC% were significantly- decreased (p<0.001) when compared with the control subjects. These measurements are more sensitive to show the severity of airways obstruction than the VC as suggested by Campbell et al.[12] However these tests in COPD without and with cardiac failure were statistically insignificant and even slightly higher except FEF 25-75% in COPD with cardiac failure subjects.

In this study in all COPD subjects ventilatory flow (FEF 25-75%) was significantly- decreased (<0.001) w-hen compared with the control subjects, which is more sensitive test than widely used FVC and $FEV_{|.}$[13] Therefore this study revealed that out of all the pulmonary function tests FEF 25- 75% are valuable as early diagnosis of COPD subjects but their correlation with severity of lung disease is not perfect these observations are supported by the work of Shepherd and Turner. Hogg et al and Keller et al. [14 l5,16]

Early detection of COPD subjects may offer the best chance to check and decrease the rising trend of mortality due to COPD. Therefore, pulmonary-function tests are valuable in diagnosis but FEF 25-75% test is more valuable than the other pulmonary-function tests for the early diagnosis of COPD.

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