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An Epidemiological Study to Assess Pulmonary Function Tests in a Cohort of Elderly Population

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Abstract

Objective: To measure the effects of aging on lung function parameters in elderly population aged 60 years and above.

Methods: The present study was undertaken on elderly population aged 60 years and above. One hundred sixty subjects were selected for the study and all of them had undergone physical and clinical examination along lung function tests. The parameters chosen were FVC, FEV1, FEV3 and PEFR. The data was analyzed using SPSS version 17.0. Mean and standard deviation (SD) was calculated.

Results: The mean value of lung function parameters in elderly male and female subjects was significantly correlated with both height and age of the subjects. The mean scores of predicted lung function in male participants were significantly higher compared to females.

Conclusion: The study revealed that all lung function indices of study subjects were significantly related to age and height.

Keywords: Prediction equation; Pulmonary function tests; Geriatric population

Introduction

Ageing process is associated with progressive constriction of the homeostatic reserve of every organ. The most important physiological changes associated with ageing are of respiratory system depicting the decrease in static elastic recoil of the lung, in respiratory muscle performance, and in compliance of the chest wall and respiratory system, resulting in increased work of breathing [1].

Life expectancy has risen sharply during the past century and is expected to continue to rise in virtually all populations throughout the world. In the United States population, life expectancy has risen from 47 years in 1900 to 77 in 2001 [2]. The proportion of the population over 65 years of age currently more than 15% in most developed countries and is expected to reach 20% by the year 2020 [3]. Healthy life expectancy, at the age of 60, is at present 15.3 years for the male population and 17.9 years for the female population [4,5]. These demographic changes have a major impact on health care.

Awareness of the basic changes in respiratory physiology associated with aging and their clinical implication is important for clinicians [6]. Numerous studies have reported that age-dependent changes of lung function through the lifespan revealed distinct differences: FEV1 and FVC keep increasing from birth to the age of 25 years, then remain stable for 5-10 years or more, and start declining in later adulthood [7-9].

The knowledge of pulmonary function tests is a basic requirement to understand the respiratory physiology for all medical physiologist and clinicians. Pulmonary function tests are important not only in the diagnosis of pulmonary diseases but also for follow up of the disease prognosis [6]. Pulmonary function tests are affected by many factors like, age, sex and height of the individuals. Keeping this hypothesis in mind the present study was done to establish the age related effects on lung function test among geriatric populace.

Materials and Methods

The present study was undertaken on elderly population of Jammu city and its outskirts aged 60 years and above. Both males and females were involved in the study.

After taking permission from the authorities running old age homes all the willing and eligible people were included in the study. A written informed consent was obtained from all the participants.

Criteria of selection

The study group comprised of all healthy, non-smoking subjects aged 60 years and above. Subjects having abnormalities of thorax, anaemia, diabetes mellitus, hypertension, bronchial asthma, pulmonary tuberculosis, common cold, chronic bronchitis, dyspnoea and emphysema were excluded from the study.

One hundred sixty subjects were selected for the study between the age of 60 to 75 years. A proforma was developed to include information like age, gender and height. All the subjects had undergone physical and clinical examination along lung function tests. The parameters chosen were:

- Percentage of Forced vital capacity (%FVC)

- Percentage of Forced expiratory volume in 1st second (%FEV1)
- Percentage of Forced expiratory volume in three seconds (%FEV3)
- Percentage of peak of expiratory flow rate (%PEFR)

Pulmonary function tests of these subjects were performed with the help of Medspiror (Records and Medicare System, Chandigarh). All the parameters were recorded. Medspiror is a computerized spirometer designed for performing pulmonary functions. It is housed in fiber glass cabinet. All the electronic circuitry, power supply, printer, display and operator's control panel are designed into it. This instrument is used with the electromechanical pneumotach transducer supplied with the instrument. The built-in thermal printer permits one or more printouts containing patient's information, calculated, predicted and percentage values on all parameters.

Statistical analysis

The data was analyzed using SPSS version 17.0 for Windows. Mean and standard deviation (SD) was calculated and reported for quantitative variables. The Spearman correlation coefficient was calculated of lung function parameters separately for male and female. A p-value of <0.01 was considered statistically highly significant, value <0.05 was considered statistically significant and that >0.05 was considered statistically non-significant.

Results

The mean value of FVC in elderly male subjects was 2.19 liters which was significantly correlated with both height and age of the subjects. The mean value of FEV1 was 1.59 liters which was also significantly correlated with both height and age of subjects. The mean value of FEV3 was 2.12 liters which was also significantly correlated with both height and age of subjects. The PEFR was significantly correlated with age but not with height (Table 1).

Parameter	Mean ± SD	Range	Correlation with r value	
			Age	Height
FVC (Lts)	2.195 ± 0.728	0.92-5.34	0.623	0.657*
FEV1 (Lts)	1.529 ± 0.662	0.1-3.08	0.55*	0.579**
FEV3 (Lts)	2.128 ± 0.673	0.94-3.37	0.671*	0.702*
PEFR (Lts/Sec)	3.400 ± 1.852	0.51-8.46	0.602*	0.601
*p<0.05, **p<0.01				

Table 1: Correlation of lung function data with age and height in male subjects.

Table 2 showed that mean values of FVC in elderly female subjects was 1.57 liters which was significantly correlated with both height and age of the subjects. The mean value of FEV1 was 1.171 liters which was also significantly correlated with both height and age of subjects. The mean value of FEV3 was 1.514 liters which was significantly correlated with both height and age of subjects. The PEFR was significantly correlated with age and with height.

Table 3 depicted prediction equations for FVC, FEV1, FEV3 and PEFR in males and females of different age (in years) and height (in cms). The mean age of the study was 70.31 years and 67.6 years for males and females respectively. The mean height was 163.6 cms and 154.6 cms for males and females respectively.

Parameter	Mean ± S.D	Range	Correlation with r value	
			Age	Height
FVC (Lts)	1.577 ± 0.552	0.52-2.73	0.739*	0.751*
FEV1 (Lts)	1.171 ± 0.520	0.24-2.63	0.729**	0.736
FEV3 (Lts)	1.514 ± 0.536	0.41-2.52	0.764*	0.810**
PEFR (L/sec)	2.827 ± 1.566	0.34-6.6	0.764*	0.766*
*p<0.05, **p<0.01				

Table 2: Correlation of lung function data with age and height in female subjects.

Parameter	Sex	Prediction equation
FVC (Lts)	Male	0.643-0.045 (age)+0.029 (ht)
	Female	3.668-0.059 (age)+0.012 (ht)
FEV1 (Lts)	Male	0.836-0.037 (age)+0.020 (ht)
	Female	3.644-0.0556 (age)+0.0086 (ht)
FEV3 (Lts)	Male	1.085-0.045 (age)+0.026 (ht)
	Female	1.637-0.056 (age)+0.024 (ht)
PEFR (Lts)	Male	12.73-0.137 (age)+0.002 (ht)
	Female	9.249-0.175 (age)+0.035 (ht)

Table 3: Prediction equation for FVC, FEV1, FEV3 and PEFR in all subjects.

Discussion

The major function of the lung is to exchange gases with the environment. As such, it's essential role is mechanical to bring the ambient air into close proximity to the output of the right heart, permitting efficient gas exchange at little energy cost [10]. Pulmonary function studies indicate the specific function of the lung that has been impaired in pulmonary diseases and give the physician a clearer concept of the disease process in each patient [11]. This study has established prediction formulae for lung function parameters in subjects residing in old age homes.

The mean age of the study subjects was 70.31 years and 67.6 years for males and females respectively. Whereas Porohit et al. conducted study among younger subjects with the mean age of 33.5 years [12]. Similarly in a study done by Noor et al among spice factory workers in Selangor showed mean age of study participants as 34 years [13].

In this study a positive correlation was found between all the parameters (FVC, FEV1, FEV3, PEFR) with age and height in male and female subjects. Similarly Krishna et al found positive correlation of FVC and FEV1, with age, height and BMI [14]. Nku et al. also observed that height was positively related to FVC (P<0.001) and FEV1 (P<0.01) in females of south eastern Nigeria [15]. Height was

also correlated positively with PEFR (P<0.001) reported in a study by of Suzanne in native American adolescents [16].

However, a weak correlation was analyzed between anthropometric and all the lung function tests in a study done by Malik AK among urban slums of Uttarakhand [17]. There were differences in values which could be attributed to other factors like, differences in body build, socioeconomic status and traditions [18].

All the lung function parameters (FVC, FEV1, FEV3 and PEFR) were found to be higher in male population as compared to females and the results were comparable to the study of Raikapoor et al. among school children of 6-13 years [19]. It could be due to more body surface area among males than females.

The present study showed reliable prediction equation for lung function indices. These findings were correlated with other studies conducted by Jaja and Ojo in 1983 among young Nigerian adults [20]; Ali and Vahalia in 1991 among school children in northern Nigerian [21]; and Njoku and Anah in 2004 among in adults of African descent [22]. However, Suzanne et al established prediction equation only with height [16]. The study has some limitations as the study subjects were from old age homes belonging to the same population with less diversity in terms of ethnicity and cultural backgrounds.

Conclusion

The study revealed that all lung function indices of study subjects were significantly related to age and height. All the lung function parameters were found to be higher in male population than females. The prediction equations for FVC, FEV1, FEV3 and PEFR obtained in this study were reliable.

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