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Spirometric Assessment of Pulmonary Function in the Elderly with Ischaemic Heart Disease

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Abstract
Studies have noted a high incidence of pulmonary function abnormalities in patients with coronary artery disease and no pre-existing pulmonary disease. This impairment function in elderly patients with ischaemic heart disease has not been adequately studied in India. Pulmonary function in the elderly patients with ischaemic heart disease was assessed spirometrically and to detect impaired lung function, if present. Subnormal pulmonary function, as evidenced by FEV1, FVC and PEFR values which were significantly lower than that predicted for normal subjects, was detected in elderly individuals with ischaemic heart disease. The pattern of the pulmonary function defect was of restrictive type in the majority. In this study, FEV1, FVC and PEFR values as a percentage of predicted tended to decline as the number of coronary arteries involved increased. FEV1, FVC and PEFR values as a percentage of predicted tended to increase as the ejection fraction increased.

Introduction

The association between impaired lung function and ischemic heart disease has been established by many studies.[1,2,3,4,5] Many researchers have noted the increased incidence of cardiovascular disease in individuals who had been earlier detected to have subnormal pulmonary function by spirometry. Recent research seems to indicate that a systemic inflammation may be the mechanism underlying the impairment of lung function and the development of coronary artery disease[6,7].

Since respiratory function tends to decrease with age, association between impaired lung function and increased morbidity and mortality may be more significant in the elderly with ischaemic heart disease. Mortality has been found to be greater among individuals with ischaemic heart disease who had impaired lung function[5]. Forced expiratory volume in one second (FEV1) as assessed by spirometry has been termed not just a lung function test but a marker of premature death from ischaemic heart disease[8,9,10].

A high incidence of pulmonary functional abnormalities in patients with coronary artery disease, who previously had no pulmonary disease, was noted in certain studies[11,12].

Thus, it has been suggested that ischaemic heart disease, itself may be responsible for impaired

lung function. T his impaired lung function may, in turn reduce survival in cases of ischaemic heart disease (especially among the elderly)[13].

However, the magnitude of the problem of pulmonary functional abnormalities in patients with ischaemic heart disease (especially among the elderly) has not been adequately studied in India. Since impaired lung function is a risk factor for future adverse cardiovascular events, there may be a case for the institution of respiratory rehabilitation in the elderly with ischaemic heart disease. There by, a new strategy to reduce morbidity and mortality among the elderly with ischaemic heart disease may emerge. But first it is necessary to identify such patients with impaired lung function. Hence, the need forth is study was felt.

Aims and Methods

The aim of this study is to assess pulmonary function in the elderly patients with ischaemic heart disease visiting Mamatha Medical College hospitals and to detect impaired lung function, if present. The prospective study was conducted on elderly patients with ischaemic heart disease visiting Mamatha Medical College hospitals between September 2013 and July 2015. Patients above 60 years of age with established coronary heart disease were included. Patients below with history of COPD, smoking, and morbid obesity were excluded. Testing of pulmonary function by spirometry was done. Doppler echocardiography was performed in all patients to determine the cardiac status. Assessment of pulmonary function was then based on the standard accepted values of the pulmonary function variables for the Indian population. The calculations were based on the validated equations derived by Udwadia et al and Kamath et al for the Indian population.

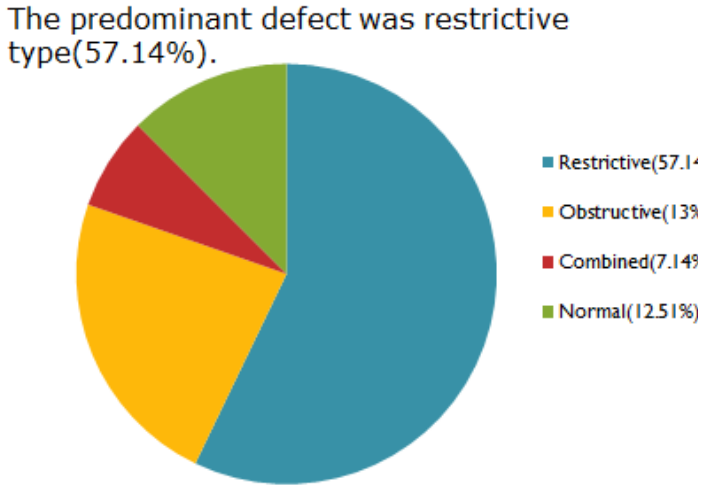
Descriptive statistical analysis has been carried out in the present study. Results oncontinuous measurements are presented on Mean □□SD (Min-Max) and results oncategorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Analysis of variance (ANOVA) has been used to find thesignificance of study parameters between three or more groups of patients, Student-t-test (two tailed, independent) has been used to find the significance of studyparameters on continuous scale between two groups Inter group analysis) on metricparameters, Pearson correlation has been performed to find the relationship of age, BMI and EF with Pulmonary function tests. The Statistical software namely SAS 9.2,SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and environment ver.2.11.1 wereused for the analysis of the data.

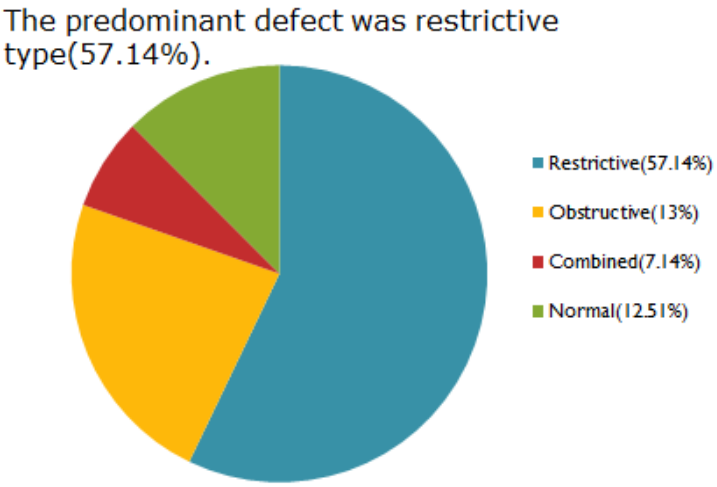
Results

The study involved 56 subjects – 41 males (73.2%) and 15 females (26.8%).Most of the subjects of this study were aged between 60 – 69 years (58.9%) mean age 69.29 ± 5.66 years. The mean body mass index of the subjects of 22 subjects this study was 25.78 ± 3.67 kg/m2 (39.3%) had an optimum BMI <25 kg/m^2but ≥ 18.5 kg/m^2. 25 subjects (44.6%) were overweight (BMI 25 – 30 kg/m2) and 9 (16.1%) individuals were obese (BMI > 30 kg/m2) Coronary angiogram had here done for 42 subjects while the remaining 14 had documented history of MI/ACS. Of the subject who had undergone angiography 20 had single vessel disease (35%) 13 had double vessel disease (23.2%) and 9 had triple vessel disease (16.1%).

The patients were considered in two groups-those aged between 60 and 70years andthose aged above 70 years. All respiratory function parameters in this study have been expressed as a percentage of the normal predicted value in the Indian population.In this study, 18 out of 36 subjects (50%) aged between 60 and 70 years had a ForcedVital Capacity less than 70% of predicted. In those aged above 70 years, 8 out of 20 subjects (40%) had a Forced Vital Capacityless than 70% of predicted.8 out of 36 subjects (22.22%) aged between 60 and 70 years had a FEV1 less than70% of predicted.In those aged

above 70 years, 5 out of 20 subjects (25%) had a FEV1 less than 70% ofpredicted.





Discussion

Lung function begins to decline slowly and steadily from middle age into old age. Thedeterioration may accelerate in old age. It is thought that a loss of elastic tissue maylead to mild subclinical emphysema even in healthy non smokers.FEV1 declines at a rate of 30 – 35 ml per year. Vital capacity decreases while the residual volume increases. Functional residual capacityalso increases with age. This may leave the diaphragm at a mechanical disadvantage, particularly if there is associated loss in height of the thorax due to osteoporotic collapse of thoracic vertebrae etc. The diffusing capacity declines linearly with age[16]. This loss is compounded by decline of pulmonary function associated with ischaemic heart disease in the elderly. Much evidence has been gathered in recent timesindicating a decline in lung function consequent to coronary artery disease.Enright et al found that coronary artery disease, on an average was associated with 40–100 ml decrements in FEV1and 50-150 ml decrements in FVC in the elderly, evenin non smokers, and in the absence of heart failure.[17]Low FEV1 has been shown to be a significant risk factor for cardiac and all cause mortality. Thus, the elderly patients with ischaemic heart disease and sub optimal lung functionrepresents a group at very high risk for cardiac and all cause mortality, including fatalarrhythmias.Enright et al studied a cohort of elderly (over age 64 years) subjects who weresomewhat healthier than average for that population. They excluded subject's who were current smokers or had smoked more than 20 pack-years. They also eliminated subjects with asthma, chronic bronchitis, and emphysema. The measurements were made at least 3 months after cardiac surgery or myocardial infarction. In this heal thier than average cohort, the authors found slightly decreased values of FEV1 and FVC insubjects with coronary heart disease. They found that coronary artery disease, on anaverage was associated with 40 – 100 ml decrements in FEV1and 50-150 mldecrements in FVC in the elderly, even in non smokers, and in the absence of heartfailure.[17]23 out of 36 subjects (63.88%) aged between 60 and 70 years had a FEV1/FVC ratiogreater than 100% of predicted and 1 individual (2.77%) had a ratio less than 70% ofpredicted. In those aged above 70 years, 16 out of 20 subjects (80%) had a FEV1/FVC ratiogreater than 100% of predicted none had a ratio less than 70% of predicted.The predominant defect was of restrictive type (57.14%). The other patterns noted inthis study were normal (12.51%), obstructive (13%) and combined (7.14%).Scanlon has speculated that ischaemic heart disease can cause pulmonary restriction[11].All the subjects in this study had a PEFR which was less than that predicted in normal's. The Peak Expiratory Flow Rate (PEFR) reflects the strength and condition ofrespiratory muscles and the degree of airflow

limitation in large airways. Studies have shown PEFR to be a predictor of mortality in the elderly[22]. PEFR is also a predictor of mortality in ischemic heart disease. Zureik M; Kauffmann F, et al have suggested that low PEFR may be related to the development of atherosclerotic plaques. Thereby, it could possibly further aggravate coronary artery disease[23]. In this study, a significant decline in FVC as a percentage of predicted ($p < 0.001$), FEV1 as a percentage of predicted ($p < 0.001$), and PEF as a percentage of predicted ($p = 0.004$) was noted as the number of coronary vessels involved increases. However the FEV1/FVC ratio as a percentage of predicted ($p = 0.763$) remained almost similar irrespective of the number of vessels involved and suggested apredominantly restrictive type of defect.

It has been speculated that a systemic inflammatory process may be contributetowards the impairment of lung function and the development of coronary arterydisease. This may also explain the frequent co existence and striking associationbetween the two disorders.

Mannino et al found that at a population level, individuals with the lowest FEV1 havethe highest levels of CRP, fibrinogen, and other systemic inflammatory markers, while those with the highest FEV1 have the lowest values.24 Engström, concluded that although associations with increased inflammatory sensitiveproteins levels contributed to the increased cardiovascular risk among men with lowFVC[7]. ISP levels and other cardiovascular risk factors could not completely accountfor the increased risk for men with low FVC. The full explanation for this relationshipremains to be explored[7].

Goswami has recently noted high levels of tumor necrosis factor-α and otherinflammatory markers in Indian patients with coronary artery disease[25].

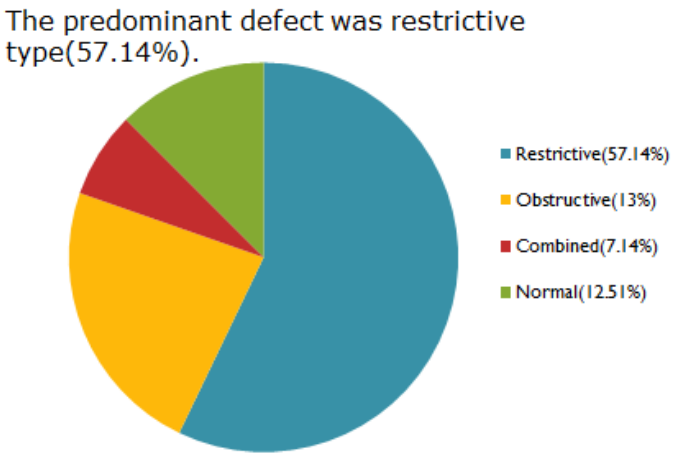
The average ejection fraction among the study subjects was 51.752%. The spirometrically assessed variables FEV1 as a percentage of predicted ($p = 0.015$), FVC as a percentage of predicted ($p = 0.004$) and PEF as a percentage of predicted ($p = 0.\ 0.009$) increase significantly with increases in cardiac ejectionfraction. However cardiac ejection fraction did not have any significant influence on theFEV1/FVC ratio as a percentage of predicted ($p = 0.692$), the overall pattern beingpredominantly restrictive.

Conclusion

In this study subnormal pulmonary function was detected in elderly individuals with ischaemic heart disease, as evidenced by FEV1, FVC and PEFR values which weresignificant lower than that predicted for normal subjects.

The pattern of the pulmonary function defect was of restrictive type in the majority. In this study, FEV1, FVC and PEFR values as a percentage of predicted tended todecline as the number of coronary arteries involved increased.

In this study, FEV1, FVC and PEFR values as a percentage of predicted tended toincrease as the ejection fraction increased.



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