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A Prospective Study of Evaluation of Pulmonary Function Test in Health and Asthmatic School Children of Kurnool

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Abstract
Introduction: *Asthma is a complex, recurrent disease of the airways that causes shortness of breath, wheezing, and cough (particularly at night or early in the morning). Asthma is episodic in nature and usually reversible, either spontaneously or with treatment. However, chronic inflammation, associated with persistent symptoms, may contribute to airway remodeling that may not be completely reversible. Airflow limitation occurs as a result of varying degrees of airway hyper responsiveness, airway edema and bronchoconstriction.*
Materials and Methods: *The study group consists of 106 school students living in Delhi for past 6 years. The prevalence of children having asthma is 7.5%. The control group, consist of sex and age matched 80 normal healthy individuals, who are school students. Taking 26 individuals as other group.Spiro-metric method was used to estimate lung function. In addition to predicted values by age, sex, height and weight, the Spiro meter measures actual respiratory flow. Following parameters were evaluated-FVC%- forced vital capacity, FEV1%-forced expiratory volume at first sec, FEV1/FVC-forced expiratory Ratio.*
Results: *Most students had their pulmonary function less than that predicted by the machine (Table. 2). Four had symptoms of obstructive respiratory picture, 52 had restrictive pattern, 48 had mild restrictive and four moderately restrictive. Those with FEV1/FVC less than 80% were labelled as obstructive. Those with FVC less than predicted value were labelled by the machine as restrictive.*
Conclusion: *Our findings suggest that exposure to air pollution can lead to a reduction in school children's lung function. Measures to improve air quality/reduce air pollution from industries, vehicles by adopting CNG/carpool/odd-even-rule, planting trees, pranayama, lifestyle changes etc. cannot be overemphasized here. The Supreme Court recently banned burning crackers in india and burning of stubble.*
Key Words: *Asthma, FEV1/FVC, CNG*

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I. Introduction

Asthma is a complex, recurrent disease of the airways that causes shortness of breath, wheezing, and cough (particularly at night or early in the morning). Asthma is episodic in nature and usually reversible, either spontaneously or with treatment. However, chronic inflammation, associated with persistent symptoms, may contribute to airway remodeling that may not be completely reversible. Airflow limitation occurs as a result of varying degrees of airway hyperresponsiveness, airway edema and bronchoconstriction.

Pulmonary function test (PFT), is a non-invasive test, used to detect air flow limitation and/or lung volume restriction. Assessment of ventilator function is an important investigation because early detection of functional impairmentand its appropriate treatment will help to reduce morbidity and mortality related to disease.Long-term deterioration of lung function in asthmatic subjects has been described in various studies. For a long time it has been believed that asthma is characterized by totally reversible airway obstruction. Now it is established that prolonged airway inflammation regulated by a variety of inflammatory cells and mediators is the central mechanism in the pathogenesis of asthma. Inflammation leadsto injuries and repair including regeneration and replacement by connective tissue. It has been hypothesized that chronic airway inflammation can lead to airway remodeling and in the long term to irreversible airway obstruction. The consequence of this process could be deterioration in pulmonary function.Asthma is characterized by the presence of reversible airflow obstruction; however, irreversible airflow obstruction develops in some patients. Morever, accelerated loss of lung function over time has been reported in groups of patients with asthma in longitudinal prospective and retrospective studies.(Lange et al,1998, Peat et al, 1987, Sears et al, 2003, Cover et al, 2004, Pascual et al,2005)reported that clinically, airflow obstruction in asthma often is not fully reversible , and many asthmatic subjects experience an accelerated and progressive loss of lung function over time.Lange et al(1998)proved that adults with asthma have substantially greater decliunes in forced expiratory volume in 1s (FEV1) over time in

comparison with healthy subjects. Accelerated decline in lung function does notoccur in all patients. The risk factors identified for accelerated decline in lung function include young age , male gender (Cover et al, 2004),duration of disease(Lee et al, 2007)more prominent eosinophilic airway inflammation (Cover at al,2004), asthma exacerbations (Bai et al, 2007),and smoking(Lee et al, 2007).Recent studies of patients with asthma selected from the general population have shown increased mortality in subjects with reduced ventilator function and have thus underlined the importance of preservation of normal lung function. (Silverstien, 1994; Lange, 1996; Huovinen, 1997).In the present investigation an attempt has been made to study pulmonary function of bronchial asthma patients. Little is known about lung function of bronchial asthma patients in this part of the region as patients are treated on the basis of clinical history and signs and symptoms and their lungfunction is rarely assessed.

II. Materials And Methods

Study Design

A cross sectional study.

Subjects

The study group consists of 106 school students living in Delhi for past 6 years. The prevalence of children having asthma is 7.5%. The control group, consist of sex and age matched 80 normal healthy individuals, who are school students. Taking 26 individuals as other group.

Sample Size

SS= Z2 X (p) X (1-p)/C2

Where, SS= sample size, Z= value A (e.g.- 1.96 for a 5% level of significance), P= prevalence percentage of children having asthma, expressed in decimal, C= 0.05(confidence level)

Exclusion Criteria

- Children having previous history and currently having treatment for pulmonary tuberculosis
- Participants having any habit which affects the lungs e.g.- smoking.
- Participants having previous history of pneumonia for the last 3 or less months.
- Children having history of silicosis, respiratory distress syndrome.

Inclusion Criteria

- Age group of 12-16 years for both study group and the control group.
- Studying in the school for greater than or equal to 6 years
- Normal healthy group having no previous history of respiratory disorder were included as controls.
- Participants having past history of asthma due to obstructive lung disease were included as study group.

Estimation of Lung Function

Spiro-metric method was used to estimate lung function. In addition to predicted values by age, sex, height and weight, the Spiro meter measures actual respiratory flow. Following parameters were evaluated-

1. FVC%- forced vital capacity.
2. FEV1%-forced expiratory volume at first sec.
3. FEV1/FVC-forced expiratory Ratio.

Estimation of Height and Weight

- Height is estimated by a stadiometer in cm.
- Weight is measured by weighing machine in Kg.

Measurement of BMI

BMI is calculated by using Quetlet's Index-Divide weight in kilograms (Kg) by height in meters and divide the answer by height again to get BMI.

Statistical Analysis

The statistical data analysis was based on the estimation of the mean, standard deviation (SD) and the category distribution according to the existence of each variable. The difference between mean values of different variables between school students having asthma and control group has been evaluating by using unpaired students test. Pearson correlation test on the entire data as well as within group is used to test whether lung function tests correlate with BMI.

III. Results

Most students had their pulmonary function less than the predicted by the machine (Table. 2). Four had symptoms of obstructive respiratory picture, 52 had restrictive pattern, 48 had mild restrictive and four moderately restrictive. Those with FEV1/FVC less than 80% were labelled as obstructive. Those with FVC less than predicted value were labelled by the machine as restrictive. Their pulmonary function was correlated with BMI in. The correlation coefficient and p values are shown in Table-2.

Demographics	Mean ± SD
Age (years)	10.7 ± 0.69
Height (cm)	149.28 ± 7.70
Weight (kg)	42.92 ± 11.32
BMI	19.07 ± 3.90

Table 1: Mean ± Standard Deviation of Pulmonary Function Test in School Children

	Predicted		% of Predicted
FEV	2.42±0.32	1.95±0.38	80.45±15.32
FVC	2.72±0.38	2.15±0.44	79.2±12.7
FEV1/FVC%	84.47±0.001	89.83±11.77	

Table 2: Mean ± Standard Deviation of Anthropometric Parameters ofSchool Children

Correlation	Pearson Correlation	Sig. (2-tailed)
FEV1 and BMI	0.204	0.036
FVC and BMI	0.256	0.008
FEV1/FVC% and BMI	-0.156	0.111

Table 3: Correlation Coefficient and Statistical Significance of Pulmonary Function Tests and BMI

IV. Discussion

The results of high FVC in children with high BMI conform to the findings of others. The reduction in lung volume due to high fat mass cancels the improvement in lung function with elevated BMI likely only in obese children and not in moderately overweight children. Smoking family, genetic predisposition and air pollution have been shown to have a negative impact on the lung function of children.

A relatively new potential risk factor for lower lung function in children is overweight. Some children's studies show a positive association. Rather than an improvement in association between BMI and FVC and FEV1. Observing different directions of BMI's lung function relationship between adults and children indicates that the adiposity-lung function relation varies with age. Historically, lower FEC and FEV1 in children with high BMI are not found in 8-year-old children. Wang and his colleagues reported a number of BMI and lung function associations in 11y. A persistently elevated BMI at 12 years of age is not yet associated with lower FVC and FEV1, indicating that at a later stage the transition from the childhood association [High BMI associated with greater lung volume] to the adult association [High BMI associated with smaller lung volume] occurs. Lung function is an objective indicator of respiratory health and a predictor of cardio respiratory morbidity and mortality. In many cross-sectional and some cohort studies, long-term effects of ambient air pollution on lung functions are investigated. Oxidative stress and inflammation are hypothesized as the key mechanisms by which environmental air pollution may affect human health. To date, only 2 studies have examined the role of exposure at different time points. Foetal et al. stated that lung function was correlated with exposure in children 9-10 years of age during the first year of life and lifelong exposure, whereas in the BAMSE cohort, lung function at 8 years of age was associated with exposure in the first year of life, but not with exposure later. Whether boys and girls are sensitive to the effects of air pollution remains unclear. We have not found significant differences in boys' and girls' interaction on clear trends in our sample. Several other researchers reported stronger girls associations, while others reported stronger boys associations or no differences. Our findings suggest that exposure to air pollution can lead to a reduction in school children's lung function. While estimated changes in the parameters of lung function are relatively small, our findings suggest the possibility of clinically relevant decreases in lung function in the entire population.

V. Conclusion

Our findings suggest that exposure to air pollution can lead to a reduction in school children's lung function. Measures to improve air quality/reduce air pollution from industries, vehicles by adopting CNG/carpool/odd-even-rule, planting trees, pranayama, lifestyle changes etc. cannot be overemphasized here. The Supreme Court recently banned burning crackers in india and burning of stubble.

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