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Original Article

Effect of High Air-Borne Pollen Count on First Degree Asymptomatic Relatives of Asthmatic Patients

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Abstract

Background: **To correlate pollen count with pulmonary function tests in first degree asymptomatic relatives of asthmatic patients as well as in asthmatic patients as control sharing common genetic and environmental exposure.**

Methods: **The study was cross-sectional comparative comprising of 120 subjects, of whom 60 were the first degree asymptomatic relatives of non-asthmatic patients. Portable office spirometry was carried out along with pollen count on the same day taken from the meterological department data.**

Result: **The spirometric variables like PEFR, FEV1, FEV6 and FEV1/FEV6 were deranged as pollen count increased. The changes in these variables were found to be present before development of clinical signs and symptoms of pollen allergy.**

Conclusion: **High risk individuals like first-degree relatives not having symptoms of pollen allergy show decrement in pulmonary function tests parameters during high pollen count seasons.**

Key Words: **Pollen Allergy, First degree relative, Portable spirometry, Bronchial hyper responsiveness.**

Introduction

High air- borne pollen count has been recognized as an important risk factor for development of bronchial asthma in the general and susceptible population. Asthma and bronchial hyper responsiveness have been found to have strong genetic basis and a number of genes have been identified causing this problem. The first degree relatives of patients with pollen allergy are thought to be a susceptible cohort to develop these problems. [1]

Variations in air-borne pollen content are the most important source of allergens in atmosphere. Over the past few years, prevalence of allergenic pollen has increased in both twin cities of Rawalpindi and Islamabad. Pollen release is influenced by circadian patterns associated with air temperature, rainfall, relative humidity and wind speed. Epidemiological studies carried out in different countries report the prevalence of respiratory allergy from 15% to 30%.[1-4] Many environmental factors contribute to increase in sensitization and development of airway allergies. Genetic- environment interactions identified to aggravate pollen allergy include tobacco smoke, pollutants and low birth weights.[4-6]

Early allergenic sensitization is a risk factor for persistent asthma. Most frequent allergens are inhalants present in pollen grain, mould fungi spores and in fragments of mycelial hyphae that stimulates asthma. Asthma as a genetic disease has an equal incidence rate by the age of 30. However, 80% of asthmatic patients are younger than 45 years. Asthma as a heterogenous disease, has many different pathways, cells and mediators invoked in the pathogenesis of the disease. T-cells, mast cells, basophils, eosinophils and B cells have been implicated as have numerous cytokines and chemokines. Persistent lung disease is a pattern of prenatal and postnatal lung development.[6]

Airway hyper responsiveness (AHR) is one of the characteristic features of asthma in which airways respond easily to various stimuli such as allergen, occupational sensitizer and infection. The rate of asymptomatic AHR varies in general population from 4% to 35%.[7,8] In certain sets of population it is noted to have very high prevalence like in industrial workers exposed to different agents from their work place. and relatives of asthmatic patients as well as in women due to gender difference of respiratory airway passages. The asymptomatic AHR is quantified by two methods, provocative concentration (PC) and provocative dose (PD). AHR was considered in the past a static property of airways but now it has shown to be a dynamic property that can vary over time and become worse after exposure to environmental sensitizer.[9,10]

In developed countries 40% of the population will be atopic and such individuals are genetically prone to manufacture antibodies of IgE class. These IgE antibodies tend to react against allergens present in the environment. [11,12]

Patients and Methods

This study was carried out in Department of Physiology, Armed Forces Postgraduate Medical Institute Rawalpindi in 2006. Total of 120 subjects comprised of 60 first degree asymptomatic relatives and 60 known asthmatic patients. The asthmatic patients were taken from asthma clinic Holy Family Hospital, Rawalpindi. In order to determine the correlation between first degree relatives and the asthmatic patients, a survey was conducted to assess the genetic aspects of the disease in which affected patients were asked to bring their parents (biological), sibling or offspring designated as first-degree relatives on a particular day. Inclusion criteria were adult men and women between 18-60 years having asthma and, first degree relatives between 14-60 years of age residing with asthmatic patients who were symptom - free from coughing, sneezing, running nose, and breathlessness during pollen season. Exclusion criteria comprised subjects with the evidence of chronic obstructive pulmonary disease, smokers, obese subjects having body mass index more than 30kg/m^2, first -degree relatives with symptoms of coughing, sneezing, running nose and history of asthma.

Relevant anthropometric data regarding age in years, weight in kilograms, height in centimeters and body mass index (BMI) defined as weight in kg/m^2 of the relatives was noted. The air-borne pollen concentrations were monitored with Burkard volumetric spore trap. Spirometry technique was used for pulmonary function testing. Data was computed and processed. Paired sample t test was applied to compare all the variables between asthmatics and relatives for statistical significance at the level of p value < 0.05. The strength of association was given by "r" value and interpreted as r= 0 – 0.5 taken as moderate and r=>0.5 as strong association.

Results

The mean ± S.D %PEFR in the asthmatic group was 23.4 ± 11.80 while in the asymptomatic group it was 43.3 ± 22.3. The difference was found highly significant (p-value = <0.001). The mean differences of %FEV1 and %FEV6 among both study groups was found highly significant (p-value=<0.001 each). The combined %FEV1/FEV6 rate was also found significant (p-value=0.005) (Table 1;Fig 1).

Frequency of pollen counts with %PEFR and %FEV1, FEV6 and FEV 1/ FEV6 was compared between both the study groups through scatter plot. Majority of the cases in asthmatic group were lying in high pollen counts while in asymptomatic relatives group the count was relatively low. (Figure 2).

Table 1: Percentage Predicted Values of Pulmonary Function Tests (Mean ± S.D)

	Mean + S.D First Degree asymptomatic Relatives (n=60)	p value Asthmatic vs First degree asymptomatic Relatives
%PEFR	43.337 + 22.307	p<0.001
%FEV1	81.919 + 53.924	p<0.001
%FEV6	79.520 + 40.665	p<0.001
%FEV1/FEV6	108.566 + 18.251	p< 0.05

Data expressed as Mean ± S.D on the basis of paired sample t-test.;p< 0.001= Highly significant, p<0.05 = Significant, p>0.05 = Non-significant

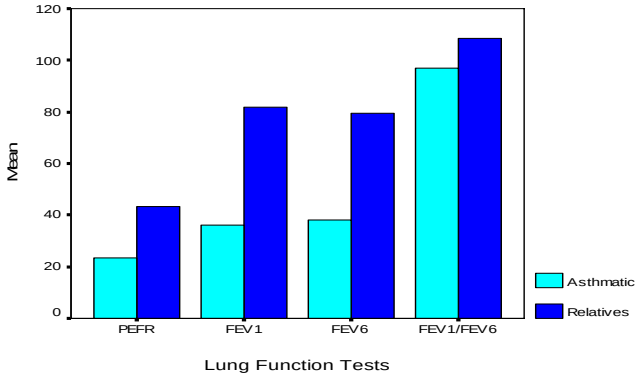

Figure 1: Mean values of lung function tests in asthmatic vs 1st degree asymptomatic relatives

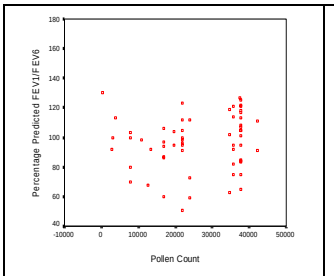

Figure 2(a): showing scatter plot of daily pollen count versus predicted percentage of lung function tests in asthmatic patients

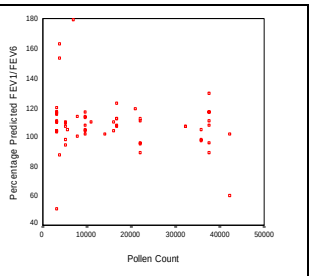

Figure 2(b) showing scatter plot of daily pollen count versus predicted percentage of lung function tests in asymptomatic relatives

Discussion

The worldwide increase in incidence and severity of respiratory allergenic diseases has been attributed to environmental factors like meteorological parameters that include minimum temperature, maximum temperature, relative humidity, industrialization, excessive vehicle emissions and changes in life style.[13] For last few years a new form of allergy has emerged as a risk factor for respiratory allergic diseases. This is due to air-borne pollen generated by different trees, grasses and weeds during particular months of the year depending upon the geographical location of the area.. Unfortunately Pakistan particularly the twin cities of Rawalpindi and Islamabad are the worst affected by this problem for the last few years. [14]

Pollen allergy has affected the asthmatic patients as well as normal people. The pollen allergy was found to be associated with various forms of allergic diseases like allergic rhinitis, allergic rhinoconjunctivitis (ACR) and respiratory problems such as asthma. Various methodologies were adopted to study the pollen allergy problem in different countries. These were immunological testing like skin prick test (SPT), fluorescent allergo sorbent assay (FAST), radio allergo sorbent test (RAST) and provocative challenge and pulmonary function testing (Spirometry).[15]

Spirometry has been used effectively to study the adverse effect of pollution on respiratory function as given in different studies carried out on coal miners, cotton ginners, and chemical mill workers and persons exposed to excessive exposure of vehicular emissions.[16]

In present study, pulmonary function tests were carried out on portable office electronic Spirometer. Most of the studies in the past were carried out on bellow type Spirometer. These spirometers were difficult to handle and heavy and gave parameters like FEV1,FVC,FEV1/FVC and EF 25-75 but for PEFR one had to use peak flow meters like Wright flow meters.

The portable office Spirometers were found to be light in weight, easy to use and these electronic Spiro meters recorded PEFR, in addition to FEV1 and instead of FVC gave timed forced expiratory volume in 6 seconds designated as FEV6.For last few years FEV6 is in use as an accepted surrogate for FVC which has certain disadvantages i.e. expiratory maneuver has to be sustained for 20 seconds or more which in certain individuals like older asthmatics and seriously ill patients is difficult and one has to urge the subject to sustain the expiration which can cause syncopal attack.FEV6 was shown to be more precise end of test criterion and less demanding for the patient and the values of FEV6 and FVC were found to have little difference.[17]

In different studies pollen allergy was found to be an important precipitating factor .. Rathore et al found that among various precipitating factors the pollen allergy is responsible in 22.39% of patients of central Punjab.[18] Jafari *et al.*, in a study carried out in rural area of upper Punjab also concluded that pollen allergy was an important risk factor. [19]

In none of the above studies paper mulberry was implicated as a source of pollen allergy but due to the unique geographical location and weather conditions in and around Rawalpindi and Islamabad this has been causing persistent allergic problem in a large number of people. Pollen allergy which used to be an occupational hazard has become a public health problem in this part of the country. The pollen count record of Rawalpindi and Islamabad in 2006 was very high in contrast to pollen count reported elsewhere in the world.[14]

Regarding scatter plots, pulmonary function tests of asthmatics and first degree asymptomatic relatives revealed that majority of cases in asthmatic group were lying in high pollen count while in asymptomatic relatives group the count was relatively low. Despite the weak strength of association the FEV1 in asthmatic and PEFR in relatives were found to be having moderate strength. Present study has proved the effectiveness of spirometry even in apparently asymptomatic high risk individuals as well. Spirometry should be used as a screening measure during high pollen season and individuals showing abnormal pulmonary function tests parameters should then be subjected to immune testing for pollens like skin prick tests and RAST assays which are invasive, expensive and require more time. The PEFR, FEV1 and FEV6 were statistically significant in asthmatics but FEV1/FEV6 was insignificant.In relatives only the PEFR was found to be statistically significant.

In many local studies the subjects were either asthmatic or suffering from allergic rhinitis and immune testing provocative challenge tests were used. Also the pollen counts were not high and duration of pollen season was very small.[20-22]

Conclusion

1. High air-borne pollen count is an important exacerbating factor for asthmatic patients.
2. Spirometry is an effective tool for screening of high risk asthmatic population

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