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Original Research Article

Prevalence of Exercise Induced Bronchial Lability in Normal First Degree Relatives of Asthmatic Patients by Detailed Pulmonary Function Tests.

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ABSTRACT

Background - Asthma is known to have a negative impact on health related quality of life. Unrecognized Exercise Induced Asthma (EIA) can result in serious public health problems. More than 10 % of the general population (6 - 13 %) with no history of asthma or allergy show exercise induced bronchoconstriction. Between 60- 90% of people with asthma experience exercise induced asthma and consider exercise a major trigger of their asthma symptoms. High prevalence of EIA demands its prompt screening and management.
Objective - Study was done to assess the prevalence of exercise induced bronchial lability in normal first degree relatives of asthmatic patients as compared to the normal subjects by detailed Pulmonary Function Tests (PFTs).
Methods - 60 subjects were divided into two groups, 30 in each. Group 1 comprising of normal relatives of asthmatic patients and Group 2 comprising of normal healthy subjects. The subjects performed a standard exercise challenged test on a bicycle ergometer for 4 to 6 min, at a maximum heart rate adjusted by increasing the resistance. FEV 1, FVC, FEF 25-75% and PEFR were measured at resting state and after exercise after every 5 min, for 30 min, using Spirolab 2 and mini Wrights peak flow meter. A fall of at least 10% in either PEFR, FVC or $FEV_{1\%}$ or a reduction of 35% or more in $FEF_{25-75\%}$ from the pre exercise value during post exercise period was considered as a positive EIA response for that subject.
Results - The overall prevalence of abnormal bronchial lability was found to be 33.3% in the healthy relatives of the asthmatics as compared to only 6.6% in the normal population.
Conclusions - Exercise induced asthma is a common and under diagnosed condition. The diagnosis of EIA should be made by a detailed history and elaborate PFTs.

Key words: Exercise induced asthma, Pulmonary Function Tests, FEV1.

INTRODUCTION

Exercise induced asthma (EIA) is the term used to describe the transitory increase in airway resistance that follows vigorous exercise. [1] In the laboratory EIA can be demonstrated in subjects who perform steady-state exercise at 80% to 90% of their predictable maximum working capacity for 4 to 6 minutes while breathing room air. [2-5] After exercise the patients should be observed for approximately 30 minutes. During this period a minimum of 3, but preferably 4 set of pulmonary function tests (PFTs) need to children. The majority of studies to asses EIA are based on the measurement of peak expiratory flow rate (PEFR). [6-8] Relatively little information is available concerning the

detailed measurement of PFTs to assess the EIA. The present study was planned to find the prevalence of EIA in the healthy first degree relations of known asthmatics by more elaborate and reliable PFTs after a standard exercise stress test.

MATERIALS AND METHODS

The study was carried out in total 60 healthy subjects of age group 18-45 yrs of either sex.

The study was carried out in two groups:

- Group 1(Control Group) - 15 males and 15 females, having no personal or family history of atopy (hay fever, asthma, eczema, rhinitis and nasal polyp).
- Group 2 (Study Group) - 16 males and 14 females, healthy first degree relations (parents, siblings) of asthmatic patients. The asthmatic patients were selected from those who fulfill the criteria of asthma as laid down by American Thoracic Society. [9]

The subjects wore light clothing and were tested at least 2-3 hours after the last meal at ambient laboratory temperature ranging between 16 - 20 degree Celsius. A detailed history was taken for each subject pertaining to the symptoms of atopy (if any), any other associated illness, history of drug intake, history of allergy to any drug / food.

I The following measurements were carried out on each of the 60 subjects:

- **Anthropometry**- height, weight, body surface area were recorded using standard methods. [10]
- **Cardiovascular parameters**- The heart rate was recorded by auscultation over precordium. Blood pressure was recorded with sphygmomanometer by auscultation method. [11]
- **Respiratory parameters**-(i) At least 3 acceptable and reproducible Maximal Expiratory Flow Volume (MEFV) curves were obtained after explaining the procedure. [12] These were monitored on the computer screen. The highest FEV_1 from the best three curves were selected for assessment of response and following parameters were computed:

Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV_1), Forced Expiratory Volume in first three seconds (FEV_3) , Forceful Expiratory Flow between twenty five to seventy five percent ($FEF_{25-75\%}$). These were recorded with Spirolab II (manufactured by MIR Medical International Research srl, Rome, Italy) with color LCD Spirometer display.

(ii) PEFR was recorded with the help of a portable Mini Wright's peak flow meter.

Any subject having FEV_1% value < 60 % of the predicted value was excluded from the study.

II All subjects performed a standard exercise challenge test on a bicycle ergometer (manufactured by INCO, Ambala, Haryana) while breathing room air through nose with mouth closed, for 6 minutes at a working intensity set from cardiac frequency criteria to require 80 % to 90% Vo_2 max, which is the normal guideline for an adult individual sub maximal work load as given by WHO. [13] Work intensities were set by adjusting the breaking resistance with pedaling rate constant for heart rate trials within subjects. [14] Before starting the test each subject were instructed to signal with his hand as soon as he feel any adverse symptoms, [15] the exercise was then immediately stopped and the subject was allowed to recover.

The bicycle ergometry has the merits that the subject is seated throughout the test, the noise level is low and the work rate can be specified. Cycling has the disadvantage that for most subjects it is an unfamiliar form of exercise and can cause undue fatigue. [16,17]

III All respiratory parameters, cardiac frequency and BP were recorded and chest was auscultated for the presence of wheeze, immediately following exercise and at

intervals of 5, 10, 15, 20,25 and 30 minutes following exercise.

For the diagnosis of EIA it is necessary to show at least 10% decrease in either Peak Expiratory Flow Rate, Forced Expiratory Volume in 1 second (FEV_1) or Forced Vital Capacity (FVC) or a reduction of 35 % or more of forced expiratory volume during 25 to 75% of FVC ($FEF_{25-75\ \%}$) from the baseline following physical exercise.

Statistical Analysis

For each variable group, mean and standard deviation of the mean were calculated according to accepted statistical methods. Intergroup differences were tested for significance by students''t' test.

Adherence to the following 'p' values was followed: p> 0.05= Not significant; p≤ 0.05 > 0.01 = Significant and p< 0.001 = highly significant.

RESULTS

It can be seen from the data presented in the Table 1, that there is no statistical significant difference in the mean values of age, height, weight and BSA in the two groups (p > 0.05). None of the subjects were involved in heavy physical activities before this study. The data given in the Table 1, suggests that the subjects groups are normally distributed. The asthmogenic effects of exercise stress test in Group I can therefore be compared statistically with those in Group II.

The observed values mean ± S.D of the Pulmonary Function parameters in the two groups of subjects at rest are given in Table 2, and compared with their mean predicted values. It can be seen that there is no significant differences in the observed PFT values from their mean predicted values (p > 0.05). The data given above suggests that the two groups are presumed to be normally distributed. The pulmonary responses to exercise in Group I can therefore be compared statistically with those in the Group II.

Prevalence of Bronchial Lability

The results of abnormal bronchial lability in two groups of subjects are given in Table 3.

It can be seen that as per the criteria of positive EIA response, the above observed differences were statistically significant. There was a much higher prevalence of abnormal bronchial lability in the healthy first degree relatives of the asthmatic patients as compared to the healthy normal controls. In Group II 33.3 % of cases had shown abnormal bronchial lability compared to only 6.6 % of cases in Group I. In Group I, abnormal bronchial lability was equally seen among males and females. In Group II, abnormal bronchial lability in females was much higher (50%) as compared to that in males (18.75%). When the percentages of abnormal bronchial lability in the two groups of subjects were compared statistically, it was found to be significant (p < 0.05).

Table 1. Mean values ± SD and significance of the anthropometric measures in the two groups of subjects.

PARAMETERS	GROUP I (N=30) Mean ± S.D	GROUP II (N=30), Mean ± S.D	significance
AGE (yrs)	26 ± 6.93	29.67 ± 5.77	NS
WEIGHT(Kg)	63.47 ± 10.93	61.5 ± 9.55	NS
HEIGHT (cm)	165.46 ± 7.98	165.4 ± 8.47	NS
BSA (m^2)	1.71 ± 0.17	1.69 ± 0.167	NS

NS - Not Significant (p> 0.05)

Table 2. Mean ± SD values and significance of resting (observed) and predicted values of PFT parameters in the two groups of the subjects.

PARAMETERS	GROUP I (n= 30)			GROUP II (n= 30)		
	OBSERVED	PREDICTED	significance	OBSERVED	PREDICTED	significance
FVC (L)	3.7 ± 0.77	3.83	NS	3.54 ± 0.53	3.87	NS
FEV_1 (L)	3.27 ± 0.62	3.38	NS	3.26 ± 0.48	3.44	NS
FEV_1%	88.57 ± 5.23	88.07	NS	92.14 ± 6.12	89.03	NS
$FEF_{25-75\%}$ (L/sec)	3.89 ± 0.97	4.13	NS	3.96 ± 0.55	4.11	NS
PEFR (L/min)	389.17 ± 43.7	389.5	NS	368 ± 16.7	377.8	NS

NS – Not Significant (p> 0.05)

Table 3. Prevalence of abnormal bronchial lability in the two groups of subjects compared (n= 30 in each group). Percentage fall in PFTs from resting levels.

Group	Sex	FVC >10%	FEV_1 % >10%	$FEF_{25-75\%}$ >35%	PEFR >10%	Positive EIA response
I	M (n=15)	1				1(6.6%)
	F (n=15)	1				1(6.6%)
II	M (n=16)	1	1		1	3(18.75%)
	F (n=14)	3	3		1	7(50%)

EIA- Exercise Induced Asthma

DISCUSSION

In the present study, an attempt has been made to study the hidden tendency towards bronchial lability in clinically healthy individuals, in a more detailed and elaborate manner. Although EIA can be strongly suspected by an appropriate history, pulmonary functions should be tested to make the diagnosis. EIA are best assessed when the persons are not symptomatic, therefore in this study, normal healthy relatives were assessed. Although this condition is preventable, it is still underdiagnosed and affects the quality of life. The purpose of this study was to evaluate the prevalence of EIB.

A number of studies have examined the diagnosis of EIA in athletes but they have not specifically used mid-expiratory flow rates as a criterion for making the diagnosis. Rundell *et al* suggested that a fall in $FEF_{25–75\%}$ of 14% is significant in the diagnosis of EIA in winter athletes. [17] One study shows that the mean fall in FEF_{50} following bronchoconstriction was accompanied by a mean fall in FVC in athletes with EIA. No "gold standard" methodology exists for athletes or non-athletes. [18] It has been suggested that $FEF_{25–75\%}$ is a more sensitive measure of obstruction in the small airways than FEV_1. [19] In our study, we used FEV_1, FVC, $FEF_{25-75\%}$ and PEFR, all for the diagnosis of the exercise induced bronchoconstriction.

The study demonstrates that pulmonary responses to exercise are quite different in the two groups. The mean PFT values were found to be higher in healthy controls than the healthy relatives of the asthmatics throughout the post exercise period. Furthermore, it was found that EIB was more prevalent among female relatives of the asthmatics as compared to the male counterparts. Our results suggest that EIB may be common among asymptomatic relatives of asthmatics. Screening is important, since EIB could be prevented with appropriate diagnosis and treatment. Although respiratory symptoms during exercise may give important clues, only these symptoms are not sufficient to establish the diagnosis of EIB. Symptomatic patients should undergo further tests for EIB.

Due to higher prevalence of bronchial lability in first degree relatives of the asthmatic patients, there are increased chances of symptomatic disease process. These symptoms if severe enough, can significantly affect the subjects, disturbing their private and professional lives. Prior knowledge of their increased susceptibility would definitely help them to prevent these symptoms and effectively manage the problem.

CONCLUSIONS

- EIA underdiagnosis may result in habitual avoidance of sports and physical activity, chronic deconditioning, weight gain, poor asthma control, low self-esteem, and reduced quality of life.
- Routine use of a reliable and valid self-administered EIB screening
- questionnaire by professionals best positioned to screen large numbers of people could substantially improve the detection of EIB.
- In this study, it was concluded that exercise induced bronchocons-triction remains to be under recognized, and its prompt diagnosis by detailed PFTs and appropriate management can prevent severe symptoms. Also, detailed history and

more elaborate PFTs must be done to diagnose exercise induced bronchoconstriction.

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