Indian J Physiol Pharmacol 1992; 36(3) : 177-180

BRONCHIAL LABILITY IN ALLERGIC RHINITIS

S. WALTER

Department of Physiology,
Christian Medical College,
Vellore - 632 002

(Received on March 20, 1992)

Abstract: The aim of this study was to assess the relationship between exercise bronchial lability and the changes in pulmonary function over a one year period in allergic rhinitis. Eighty four nonsmoking male medical students of whom twenty two were allergic rhinitics were studied. Pulmonary function status was significantly lower and exercise bronchial lability significantly higher in the allergics. Over a one year period the mean decline in the forced expiratory volume in one second (FEV_1) was three times greater and in the forced expiratory flow rate in the middle half of the vital capacity (FEF 25-75%) 50% greater among the allergics. The change in FEV_1 was positively related to the bronchial lability, indicating that greater bronchial lability was associated with less decline in pulmonary function in these subjects.

Key words: allergic rhinitis; exercise lability index; bronchial lability; pulmonary function

INTRODUCTION

Bronchial hyper-reactivity is a well recognized characteristic of asthma (1). It is also said to be present in some patients with allergic rhinitis (2). Hyper reactivity is often assessed as the airway response to a standard stimulus, usually exercise or an inhalation challenge (3). Exercise bronchial lability studies done on young smokers in our laboratory indicate that greater bronchial lability is associated with less decline in pulmonary function (4). Studies reported on the natural history of allergic rhinitis indicate that a large proportion tend to develop bronchial asthma later in life (5). If bronchial lability testing could indentify those allergics who are prone to develop asthma later, it could be of prognostic value (6). The aim of this study therefore was (i) to assess exercise bronchial lability in allergic rhinitics and (ii) to detect the relationship between bronchial lability and pulmonary fuction decline during a one year period in these subjects.

METHODS

A cohort of 84 nonsmoking male medical students participated in this study. Subjects with bronchial asthma were not included. Allergic rhinitis was identified using the criteria of Broder et al (7). Twenty two subjects had allergic rhinitis. Their age, height and weight are given in Table I. There was no significant difference in these parameters between the two groups.

TABLE I : Physical characteristics of the subjects.

	Normal n = 62		*Allergic rhinitis* n = 22		
	Mean	*SD*	*Mean*	*SD*	*P*
Age, yrs	20.3	2.30	19.70	0.96	n.s
Height, cms	171.2	5.98	170.8	4.59	n.s
Weight, kgs	57.4	7.01	57.7	7.98	n.s

The tests on all the subjects, were performed at the same time of the day to avoid possible diurnal variations. Forced expiratory spirograms (FES) were obtained using a Collins respirometer and peak expiratory flows (PEF) using a Wright peak flow meter. Forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), FEV_1 expressed as a percentage of FVC (FEV_1) and forced expiratory flow in the middle half of the FVC (FEE 25–75%) were obtained from the FES. All flows and volumes were expressed at BTPS.

Exercise bronchial lability was determined using the exercise lability index (EL1) (8). The test exercise used has been described earlier (4). EL1 was calcualted as the difference between the highest and the lowest values of the pulmonary function parameter expressed as a percent of its initial value before the test exercise. The dilator and constrictor components of the EL1 were also calculated. These were expresed as EL1-% rise and EL1–% fall, calculated using the difference between the highest and the initial, and the lowest and the initial values respectively.

The FES and PEF on these subjects were repeated one year later. Statistical measures used (9) were (i) the students t test for comparison of the initial values of the normal and allergic subjects, (ii) the paired t test for analysing the one year changes in pulmonary function and (iii) the correlation coefficient for assessing the relationship between bronchial lability and change in pulmonary function.

RESULTS

Table II gives the pulmonary function and bronchial lability values in the subjects at the start of the study. FEV_1, $FEV_1\%$, FEF25-75% and PEF were significantly lower and EL1-PEF significantly higher among the allergics. Fig. 1 shows the dilator and constrictor components of the EL1. Both were greater in the allergics.

TABLE II : Pulmonary function and bronchial lability.

	Normal		*Allergic rhinitis*		
	Mean	*SD*	*Mean*	*SD*	*P*
FVC, litres	4.04	0.58	4.01	0.37	ns
FEVl, litres	3.48	0.50	3.20	0.26	<.02
FEVl %	86.4	5.71	80.2	8.03	<.001
FEF 25-75%					
1/sec	4.06	0.90	3.25	0.66	<.001
PEF, 1/min	520.00	50.66	487.0	51.12	<.001
EL1-PEF	7.98	3.39	12.68	5.16	<.001
EL1-FEV1	4.90	5.13	7.00	6.26	ns
EL1-FEF 25–75%	14.03	12.77	20.05	13.30	ns

Over the period of one year, the decline in FEV_1 and FEF25-75% was 3 and 1.5 times greater respectively in the allergics than in the normals (Fig. 2).

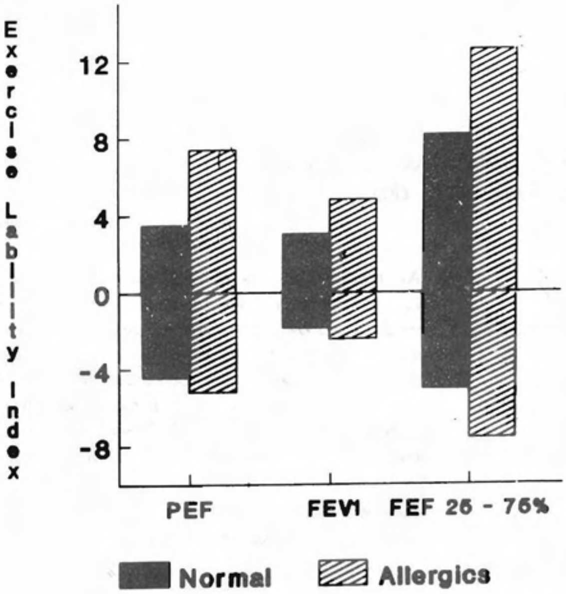

Fig. 1 : Bronchial lability and its components in the normal and allergic subjects. The zero line represents the pre-exercise flow rates and values above and below this line indicate the % rise and % fall in flow rates in response to exercise challenge.

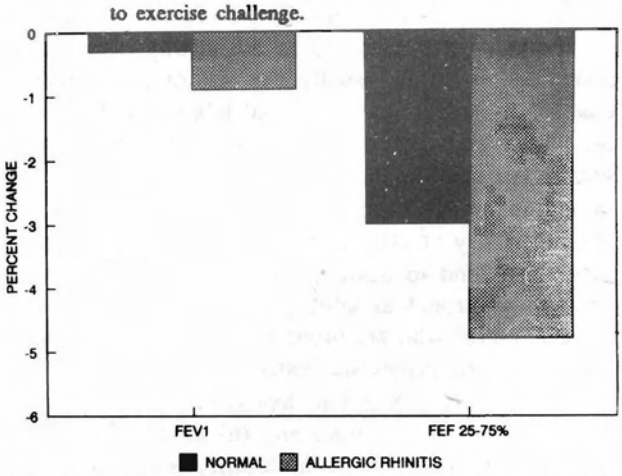

Fig. 2 : **Decline in FEV_1 and in flow rates during one year in the normal and allergic subjects.** The zero line indicates values at the start of the study, and the ordinate, the percent change in values.

Table III shows the relationship between the exercise lability index and the decline in FEV1 in the allergic subjects. There was a positive relationship between the two. This relationship was even stronger when the dilator component of the lability, ie the EL1-% rise was tested.

TABLE III: Relationship between bronchial lability and change in pulmonary function (FEV_1) in the allergic subjects.

	r
EL1–PEF	+ 0.314
PEF% rise (dilator component of lability)	+ 0.372
PEF% fall (constrictor component of lability)	– 0.06

r = correlation coefficient

DISCUSSION

This study demonstrates that subjects with allergic rhinitis have significantly lower airway function than normal. They also show a greater than normal decline in airway function which is measurable even within a period of one year. These findings support results reported earlier from our laboratory (10,11).

The allergics also have a significantly greater bronchial lability. The normal response to a short bout of exercise is an initial bronchodilatation followed by a bronchconstriction. The bronchodilatation could be due to a combination of factors. A decrease in vagal tone and increased beta adrenergic stimulation are known to occur during exercise (12). Inhibitory mediators such as some prostaglandins may also play a role in causing the bronchodilatation (13). This response is transient and is followed by bronchoconstriction, which is believed to be caused by mediator release resulting from airway cooling or osmolality changes (14).

An increase in exercise induced bronchial lability can be produced by an increase in bronchodilatation during exercise, increase in bronchoconstriction after exercise or a combination of both. In our study, the increased bronchial lability in the allergics was due to an increase in both, the dilator as well as the contrictor components. This could be a reflection of a greater parasympathetic tone in the bronchi of the allergics, a decrease of which would cause a greater degree of bronchodilatation. Increase in mediator release, or a greater sensitivity to released mediators may also play a part.

Greater bronchial lability was associated with less decline in airway function during a one year period in the allergics. This association was even stronger for the dilator component of bronchial lability, ie those with greater capacity for bronchial dilatation had less decline in airway function. Several published reports indicate that exercise may have a beneficial effect on airway function. Thus exercise of short duration while it lasts, has a protective effect on airways against bronchoconstriction and bronchoconstriction caused by cigarette smoking can be rapidly reversed by exercise. Propranolol does not block this exercise bronchodilatation, but atropine does (15), suggesting inhibition of vagally mediated reflexes rather than beta adrenergic mechanisms.

Similarly, repeated short sprints are protective in exercise induced asthma, by inducing bronchodilatation (16), and methacholine airway responsiveness decreases during exercise in asthmatic subjects (17). High lability of airways has been found to be associated with the best chance of improvement in asthma (18). We have observed also in young smokers, that greater bronchial lability is associated with less decline in airway function (4). These findings suggest that factors that increase bronchial lability, or more specifically the dilator component of bronchial lability may improve airway function. Thus suitable exercise regimens, breathing exercises or yogic practices which help to increase bronchial lability need to be identified. These could prove to be of long term benefit for airway dynamics.

ACKNOWLEDGEMENTS

This study was financed by the Fluid Research Fund of the Christian Medical College. The author is thankful to the subjects for their cooperation and participation in the study.

REFERENCES

1. Simonsson BG. Clinical implications of bronchial hyperreactivity. *Eur J Resp Dis* 1980; 61 : (Suppl 106) 7-18.
2. Fish JE, Rosenthal RR, Batra G, Menkes H, Summer W, Permutt S, Normal P. Airway responses to methacholine in allergic and nonallergic subjects. *Am Rev Respir Dis* 1976; 113 : 579-586.
3. Tattersfield AE. Measurement of bronchial reactivity: a question of interpretation (Editorial). *Thorax* 1981 : 36 : 561-565.
4. Walter S, Boyapati J. Bronchial lability and its relationship to pulmonary function decline in young asymptomatic smokers and nonsmokers. *Ind J Chest Dis & All Sci* 1984; 26: 205–213.
5. Rackemann FM, Edwards MC. Asthma in children. A follow up study of 688 patients after an interval of twenty years. *New Eg J Med* 1952; 246 : 815-823.
6. Cropp GJA. Exercise induced asthma. The Paed Cl of N Am : *Symposium on Paed All* 1975 ; 22 : 63–76.
7. Broder I, Higgins MJ, Mathews KP, Keller JB. Epidemiology of asthma and allergic rhinitis in a total community, Tecumseh, Michigan. *J All* 1974; 53: 127–138.
8. Konig P, Godfrey S, Abrahamov A. Exercise induced bronchial lability in children with a history of wheezy bronchitis. *Arch Dis Childh* 1972 : 47: 578-580.
9. Snedecor GW, Cochrane WG. Statistical methods. 6th edition. Calcutta : Oxford and IBH Publishing Co. 1967.
10. Walter S, Mathew V. Respiratory allergies in a population of medical students in south India. *Ind J Chest Dis & All Sci* 1985; 27 : 211–218.
11. Walter S, Richard J. Longitudinal study of lung function development in a cohort of Indian medical students : interaction of respiratory allergy and smoking. *Indian J Physiol Pharmacol* 1991; 35 : 44–48.
12. Chryssanthopoulos C, Barboriak JJ, Fink JN, Stekiel WJ, Maksud MG. Adrenergic responses of asthmatic and normal subjects to submaximal and maximal work levels. *J All Clin Immunol* 1978; 61: 17-22.
13. Gelb AF, Tashkin DP, Epstein JD, Gong H Jr, Zamel N. Exercise induced bronchodilatation in asthma. *Chest* 1985; 87: 196-201.
14. Gilbert IA, Fouke JM, Mc Fadden Er Jr. Heat and water flux in the intrathoracic airways and exercise induced asthma *J Appl Physiol* 1987; 63 : 1681–1691.
15. Kagawa J, Kerr HD. Effects of brief graded exercise on specific airway conductance in normal subjects. *J Appl Physiol* 1970; 28 : 138–144.
16. Schnall RP, Landau LI. Protective effects of repeated short sprints in exercise-induced asthma. *Thorax* 1980; 35 : 828–832.
17. Inman MD, Watson RM, Killian KJ, Obyrne PM. Methacholine airway responsiveness decreases during exercise in asthmatic subjects. *Am Rev Respir Dis* 1990; 141 : 1414-1417.
18. Blackhall MI. Effect of age on fixed and labile components of airway resistance in asthma. *Thorax* 1971; 26: 325-330.