

Incidence of Exercise-Induced Asthma in Adult Asthmatics

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One-hundred and fourteen adults (48 males, 66 females, average age 35.5 years, range 16–61 years) were tested for bronchial asthma. Eighty-nine were given the clinical diagnosis asthma bronchiale. Of these 89 patients 68 (76%) had exercise-induced fall in PEF. Twenty-one (24%) showed no fall in PEF. The incidence of exercise-induced fall in PEF was the same among patients with extrinsic as among patients with intrinsic asthma. Out of 25, in whom the clinical diagnosis asthma bronchiale was not confirmed, only one patient had exercise-induced fall in PEF. This patient had chronic bronchitis. Twelve adults without any disease showed no fall in PEF after exercise.

Key words: adult asthmatics; exercise-induced asthma; incidence.

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The incidence of exercise-induced asthma (EIA) in children has been found to be between 50 to 95% (10, 11). It has been claimed that a fall in peak expiratory flow (PEF) after exercise occurs so constantly that the absence of this symptom in a child should cause doubt about the diagnosis asthma bronchiale. The intention of this study was to find the incidence of EIA in adult asthmatics.

PATIENTS

This study concerns 114 adult patients who were referred to the Clinic of Allergology, Rigshospitalet, Copenhagen, with a diagnosis of bronchial asthma. All patients between 15 and 65 years were studied either as outpatients or hospitalized.

Forty-eight males and 66 females participated, the youngest was 16, the oldest 61, average age was 35.5 (s.d. $\pm$ 12). The exercise test was performed at a time when the patients were not suffering from acute distress. A few patients dropped out because they were unable to perform the exhausting exercise.

Twelve adults without any disease were also tested with the exercise-test.

METHODS

Diagnostic criteria

The diagnosis bronchial asthma was given to patients who either improved their lung function more than 20% after inhalation of β_2 -agonist spray or showed an impairment of more than 20% in lung function after inhalation with 500 μ g or less of histamine. Lung function was assessed by PEF and forced expiratory volume in the first second (FEV₁).

The diagnosis extrinsic asthma was given to patients in whom one or more relevant antigens were found. This diagnosis was based on history, prick-test, nasal- and bronchial provocations, IgE (increased > 263 U/ml), blood eosinophils (increased > 350 mill/l), allergen-specific IgE by RAST, histamine liberation from basophils.

The intrinsic asthma diagnosis was given to patients where no relevant antigen was found.

All patients admitted to the department with a diagnosis of bronchial asthma were tested according to the above-mentioned criteria. One doctor on the department decided on the clinical diagnosis of bronchial asthma for each patient, without knowing the result of the exercise test. At the same time the sub-diagnosis intrinsic or extrinsic was given.

These classifications are seen in Table 1.

Exercise test

The exercise test was performed as free running, supervised by a doctor who was not aware of the diagnosis of the various patients. The duration of the free run was 6 min. It was checked that the pulse rate was more than 160 beat per min after 2 min of running. PEF was measured before the exercise and 2 and 4 min after the exercise had started. Immediately after exercise was stopped and 2, 4, 6, 8, 13 and 18 min after exercise, PEF was also measured. If PEF was less than 60% of the highest measured value during the test, active treatment was given with β_2 -agonist spray (Ventoline®).

Patients were considered to have exercise-induced fall in PEF (positive exercise test) if the lowest measured PEF after exercise was less than 80% of the highest measured before, during or immediately after exercise (TB-Index). If pre-exercise PEF was 400 l/min, the highest PEF during or immediately after exercise was 450 l/min and the lowest PEF after exercise 350 l/min, then the *fall* in PEF after exercise in per cent would be $(450-350)/450 = 22\%$. In this case the exercise test would be considered positive, because the lowest PEF after exercise was less than 80% of the highest PEF immediately before or immediately after exercise, namely $350/450 = 78\%$.

Statistics

To compare the incidence of exercise-induced asthma among patients with intrinsic and patients with extrinsic asthma, χ^2 -test was used.

RESULTS

Out of the 114 patients, 89 were given the clinical

diagnosis bronchial asthma. Average age 34.5 years (s.d. 11.8). Out of these 89 patients, 68 (76%) had positive exercise test (Table 1).

Sixty-five of the 89 patients with bronchial asthma were classified as having extrinsic asthma, 51 of whom had positive exercise test. Twenty-four were classified as having intrinsic asthma, 17 of these had positive exercise test. There was no difference between the incidence of positive exercise test among these two groups ($\chi^2 = 0.556$, $\mu = 1$, $P = 0.4$).

Twenty-five (average age 37.6 years, s.d. 14.1) of 114 patients examined were not diagnosed as bronchial asthma. Twenty-four of these had negative exercise tests (Table 2). One patient with positive exercise test had chronic bronchitis. Twelve adults without sign of disease had negative exercise tests.

DISCUSSION

The patients were studied with free running because this was thought to be the type of exercise which gave the most severe decrease in PEF (1, 7).

The result that 76% of the studied adults with bronchial asthma had a decrease in PEF after exercise, correlates well with the incidence of EIA among children, which has most often been found to be between 60 and 95%.

The figures from this study are, however, not directly comparable with the incidence studies among children, because the incidence of EIA among children is estimated from the decrease in PEF after exercise, compared with the PEF measured immediately *before* exercise. This study compared the lowest PEF after exercise

Table 1
Outcome of exercise tests in 89 asthmatic patients

	Positive exercise test	Negative exercise test	
Extrinsic asthma	51	14	65
Intrinsic asthma	17	7	24
	68	21	89

Table 2

Outcome of exercise tests in 25 patients without asthma

	Positive exercise test	Negative exercise test
Emphysema	0	1
Chronic bronchitis	1	2
No lung diseases	0	21

with the highest measured PEF. If, in the studies of incidence of EIA among children, the criteria of a positive test had been the same as in this study, the incidence of positive exercise test might have been even higher.

Sixty-one of the asthmatics in this study showed a fall greater than 15% comparing the lowest post exercise PEF with the baseline value. Still, one patient (with chronic bronchitis) would have positive exercise test, without having the diagnosis bronchial asthma. Using the Jones Lability Index (9) and judging the exercise test positive when rise plus fall exceeds 20%, 68 patients with the diagnosis bronchial asthma would have positive exercise test. But in this case three patients without the diagnosis bronchial asthma would have a positive exercise test. Two of these had chronic bronchitis and the third was a smoker who had a rise of 24% and a "fall" of - 4% (i.e. PEF before exercise, 250 l/min, immediately after, 310 l/min, and the lowest post exercise value, 260 l/min) (Table 3).

Table 3

Comparing top-bottom index (TB-Index) with decrease from baseline and Jones Lability Index. No. of patients

	Positive exercise test	Negative exercise test	False positive exercise test
TB-Index	68	21	1
Decrease from baseline	61	28	1
Jones Lability Index	68	21	3

It has been thought that the early bronchodilatation which is often, but not always, seen during exercise, reflects an increased sympathetic drive during exercise (8). The influence of serum-catecholamines on EIA has never been proven, but β_2 -receptor blockade with propranolol (12) did not inhibit an increase of pulmonary function during exercise. It has also been shown that β_2 -agonist (given perorally) did not alter the pulmonary reaction after exercise (2). It therefore still has to be proved that the increase in pulmonary function at the beginning of exercise is caused by a sympathetic drive.

As some information may be lost by ignoring the improvement of lung function during exercise, the fall in PEF after exercise in this study was assessed by comparing the lowest PEF after exercise with the highest PEF measured before, during or immediately after exercise.

Normal subjects studied under standardized running have been shown to have a fall in PEF after exercise of 9 to 10%, expressed as a percentage of the resting value (3, 5). In this study the fall in PEF was compared with the highest value before, during, or immediately after exercise. After exercise the PEF should fall to less than 80% of the highest measured value, before the test was regarded as positive. The normal persons in this study all had negative exercise test, which together with the fact that normal persons do not show an increase in PEF during or immediately after exercise of more than 10% gives a safe limit for a positive exercise test used in this study.

Nothing was done to standardize the temperature and humidity in the surroundings, or the degree of hyperventilation, although these factors are of importance for the test (4, 13).

The conclusion is: if in doubt about the diagnosis of bronchial asthma, have the patient perform an exercise test. If the exercise test is positive, there is little doubt that the patient has bronchial asthma. If the patient performs an exercise test and shows no fall in PEF or a fall which is less than 20% of the highest measured PEF before or immediately after exercise, it is advisable to seek extra confirmation of the diagnosis, before stating that the patient has bronchial asthma.

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