

Intradermal skin tests with *Dermatophagoides pteronyssinus* in asthmatic children: correlation with specific IgE and bronchial provocation tests

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Summary

The purpose of the present study was to compare the results of the skin tests, the specific IgE levels and bronchial provocation tests in a group of sensitive asthmatic children with a *Dermatophagoides pteronyssinus* extract standardized by the RAST inhibition method. Skin tests showed a positive 'end point' in twelve children of 0.5 U/ml antigen; in eleven 5 U/ml; seven of 50 U/ml; six of 500 U/ml. Specific IgE was present in thirty-three children (92%). A close relationship between positive skin tests and serum IgE levels was found. Bronchial provocation tests were positive in twenty-eight children (78%): eight children with both positive RAST and positive skin tests had negative bronchial provocation tests.

Introduction

For about half a century the only method of diagnosing allergic respiratory diseases has been from skin tests (Voorhorst & Van Krieken, 1975). Recently more reliable methods have been introduced, and among these bronchial provocation tests (BPT) (Aas, 1970; Collins *et al.*, 1973; Cardoso & Falliers, 1974; Spector & Farr, 1974) and detection of specific IgE antibodies (RAST) (Aas & Johansson, 1971; Berg & Johansson, 1974; Pepys, Roth & Carrol, 1975) have had the most widely diagnostic application.

The purpose of the present study was to compare the results of skin tests, specific IgE levels and BPT in a group of thirty-six asthmatic children sensitive to *Dermatophagoides pteronyssinus* (*D.pt.*).

Skin tests, RAST and BPT were carried out with a *D.pt.* extract standardized by us by the RAST inhibition test. Our data show a close relationship between skin tests, serum specific IgE antibodies and BPT.

Patients and methods

Thirty-six asthmatic children, twenty-six male and ten female, who had positive intradermal skin tests only for *D.pt.* were included in the present study. The other allergens tested were: animal danders, moulds and grass pollen. The average age was 8 with a range of 5–14 years and all the children were in good health and without upper respiratory tract infections or any kind of asthmatic or allergic manifestations at the time of testing. All antihistamines, sympathomimetics, corticosteroids and sodium cromoglycate were withdrawn 1 week before the tests. None of the children had received hyposensitisation treatment.

Allergen extracts

The potency of the *D.pt.* extract was evaluated by the RAST inhibition method (Tangen & Nilsson, 1975; Falagiani, Centanni & Noferi, 1976) and the same allergen preparation was used for the *in vivo* and *in vitro* tests. Each child was also tested with a routine batch of common allergens including moulds, animal danders, house-dust and pollen 1:1000 (Lofarma, Milano) and Coca's solution was used as the control.

Skin tests

The intradermal tests were made on the volar surface of the forearm. 23 needles and 1 ml disposable syringes were used. Patients were tested with serial dilutions (0.5, 5, 50 and 500 U/ml) of *D.pt.* extract; 0.03 ml of solution was injected and the reaction read at 20 min; (+ = erythema 10 mm larger than the control, ++ = erythema and weal 10 mm larger than the control, +++ = erythema, weal and pseudopodia). The weakest allergen extract dilution giving a positive reaction was defined as the 'end point'.

Specific IgE antibodies to *D. pteronyssinus*

Specific IgE antibodies to *D.pt.* were measured by the RAST method using Phadebas RAST (Foucard *et al.*, 1972). A blood sample for RAST analyses was drawn from each subject at the time of the skin testing procedure. Serum was stored at -20°C until the RAST was performed. Results were expressed as a percentage of bound specific radioactivity (= patient serum ct/min.—normal serum ct/min.: total activity added. As normal, control umbilical cord serum was used). Background laboratory radioactivity was 1–2%.

Bronchial provocation tests

Before BPT vital capacity (VC) and forced expiratory volume in one second (FEV₁) were recorded three times. The highest value obtained was employed for BPT. The BPT were only performed on those children whose FEV₁/VC ratio $\geq 80\%$. As a control the children first inhaled a saline solution, the vehicle for the *D.pt.* extract. If there was no significant response, BPT were carried out with 0.5 ml of *D.pt.* solution at serial concentration from 5 to 500 U/ml. The patient inhaled the solution from nebulization delivered by a mechanical intermittent pressure ventilator. In the absence of a bronchial reaction the test was repeated at 15 min intervals increasing the concentration of the *D.pt.* solution until a positive reaction was obtained. After 15 min of nebulization the following parameters were recorded: VC, FEV₁ and FEV₁/VC. The test was

considered positive when the FEV₁ decreased by at least 15% of its initial value. The adopted theoretical values were those of Cook & Hamman (1961).

Results

Skin tests showed a positive end point in twelve children of 0.5 U/ml of *D.pt.* extract; in eleven of 5 U/ml; in seven of 50 U/ml and in six of 500 U/ml of antigen (Table 1).

In thirty-three children (92%) specific IgE antibody tests gave positive results: in eight the bound specific radioactivity was between 2 and 10%; in five between 10 and 20%; in six between 20 and 30%; in twelve between 30 and 40%, and in two between 40 and 50%.

There was a close relationship between the degree of skin sensitivity and IgE specific levels ($r=0.435$; $P<0.01$). The children who showed a positive end point at the lowest allergenic concentration, had higher serum levels of IgE (Fig. 1).

The BPT were positive in twenty-eight children (78%); eight with both positive skin tests and positive RAST gave negative BPT. No relationship was found between the degree of skin and bronchial sensitivity ($r=0.027$; $P=n.s.$) (Fig. 2) and between specific IgE levels and bronchial sensitivity ($r=0.102$; $P=n.s.$) (Fig. 3).

Table 1. Comparison between intradermal skin tests, RAST and bronchial provocation tests (BPT in thirty-six children allergic to *Dermatophagoides pteronyssinus*

Intradermal skin tests: end point (U/ml)	Cases (no.)	Percentage positivity			
		RAST	(no. cases)	BPT	(no. cases)
0.5	12	100	(12)	83	(10)
5	11	91	(10)	82	(9)
50	7	100	(7)	71	(5)
500	6	66	(4)	67	(4)

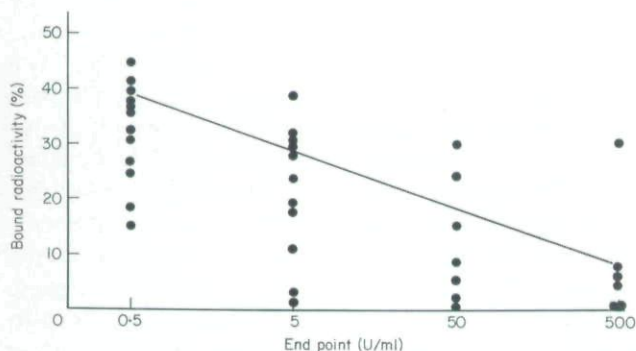


Fig. 1. Comparison between intradermal skin tests and RAST in thirty-six children suffering from *Dermatophagoides pteronyssinus* asthma. $r = -0.435$; $P < 0.01$.

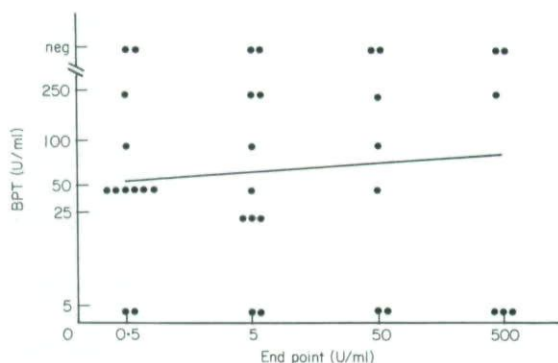


Fig. 2. Comparison between intradermal skin tests and bronchial provocation tests in thirty-six children suffering from *Dermatophagoides pteronyssinus* asthma. $r=0.027$; $P=n.s.$

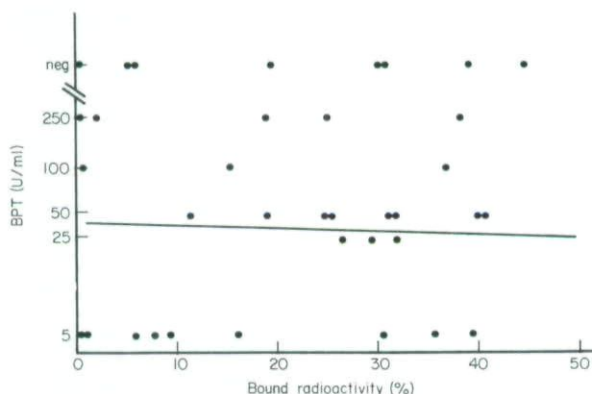


Fig. 3. Comparison between RAST and bronchial provocation tests in thirty-six children suffering from *Dermatophagoides pteronyssinus* asthma. $r=0.102$; $P=n.s.$

Discussion

Our data show that out of thirty-six asthmatic children with skin tests positive to *D.pt.*, thirty-three had specific IgE and twenty-eight positive BPT to the same allergen. A close relationship ($P < 0.01$) was shown to exist between the degree of skin sensitivity and serum IgE specific levels; while the correlation between the skin and bronchial sensitivity and between specific IgE and bronchial sensitivity was negligible. The correlation between specific IgE and skin tests was even more evident in children with an end point positive at the lowest allergenic concentration. The agreement of our results obtained with three different diagnostic methods is higher than that reported by others (Aas, 1970; Collins *et al.*, 1973; Ahlstedt *et al.*, 1974; Bruce *et al.*, 1974); this could be due to the use of the same allergenic extract assay in the three diagnostic tests. It is in fact probable that apparent inconsistency in the results obtained with skin tests, RAST and BPT is due to the use of allergenic extract differing in their allergenic concentration. Therefore the standardization of allergens is necessary in order to correlate the results obtained with different diagnostic methods. It is difficult to interpret the negative BPT observed in eight children with both positive skin tests and RAST. Of course a bronchoconstriction induced by BPT differs from a spontaneous

attack (Lowell & Schiller, 1948; Schiller & Lowell, 1952). It is known that several triggering factors such as respiratory infections, psychological problems, weather changes, cigarette smoke etc. can influence the natural course of allergic asthma and sometimes exposure alone to the allergen is insufficient to induce an attack. Moreover FEV₁ is not the most sensitive pulmonary function test in detecting peripheral bronchoconstriction; perhaps other more sensitive pulmonary function tests might have been positive in these eight children.

In conclusion, intradermal tests are still a reliable method for allergic diagnosis in asthmatic children. RAST and BPT should be used in cases of difficult interpretation and for the evaluation of progress in specific hyposensitization therapy (Aas, 1971; Tuchinda & Chai, 1973; Apold *et al.*, 1974; Bryant, Burns & Lazarus, 1975).

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