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A Study on the Binding Affinity of Salicylate to Serum Albumin in Allergic Disease

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Introduction

Hearing anamnesis is the most important in the diagnosis of allergic disease. As tests for allergic disease, we can mention the scratch test, intracutaneous test,Prausnitz Küstner (P-K) test and Radioallegrosorbent test (RAST). These tests are mainly aplicable to detection of detrimental immune reaction rather than allergic disposition.

From general view on the allergic disease, the patients are supposed to have allergic disposition related to heredity. In the present work we studied the possibility of the affinity of salicylate to serum albumin to detect the allergic disposition.

Subjects and Methods

The subjects were patients with drug allergy, bronchial asthma, other type 1 allergic diseases, rheumatic fever, acute glomerulonephritis, nephrotic syndrome and juvenile rheumatoid arthritis. The number of which were 18, 38, 34, 14, 19, 6 and 5, respectively.

We studied also 29 family members belonging to Group A diseases, ie, drug allergy, bronchial asthma and other type 1 allergic diseases and 39 family members with Group B diseases, ie, rheumatic fever, acute glomerulonephritis, nephrotic syndrome and juvenile rheumatoid arthritis.

One hundred thirty-six healthy persons whose family members had no allergic disease were selected as normal control.

Serum specimens in all cases were collected from those who recovered from allergic diseases and Group B diseases and did not take any medications at least for three days.

Sodium salicylate (2g/dl) was added to 2ml of serum and the concentrations of free salicylate and bound salicylate were determined by the Sephadex Gel batch technique[1)].

Serum total protein was determined by biuret reaction.Fractionation of serum albumin was made by cellulose acetate electrophoresis. And analysis was carried out by densitometer.

The percentage of binding salicylate was expressed as bound salicylate/total salicylate × 100 (%).

Further, the index of the percentage of binding to serum albumin (abbreviated it to bound %/alb index) was also calculated.

Results

1 Normal group (Fig. 1)

The bound %／alb index was distributed over 12.7～24.7. The mean value was 18.1± 2.4.

2 Disease group (Fig. 1)

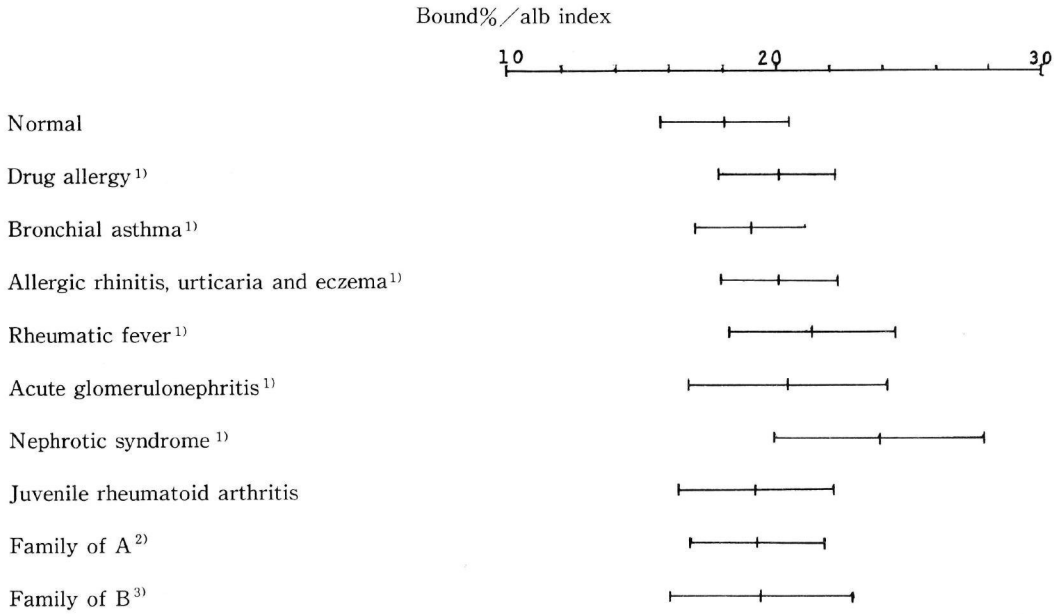
The mean value for bound % ／ alb index in the group of drug allergy, bronchial asthma and other type 1 allergic diseases was 20.1±2.2, 19.7±2.2, 20.1±2.2, respectively, each of which was significantly higher than that in the normal control group ($p < 0.001$).

The mean value for the bound %／alb index in the group of rheumatic fever, acute glomerulonephritis and nephrotic syndrome was 21.3±3.1, 20.4±3.7 and 23.8±3.9, respectively, each of which was significantly higher than that in the normal control group ($p < 0.001$).

The mean value for the bound %／alb index in juvenile rheumatoid arthritis was high at 19.2 ± 2.9. However they showed no significant difference from the normal control.

3 Family group (Fig. 1).

The mean value for the bound %／alb index in the Group A and B family were higher than that in the control group as shown in the Fig. 1. And the diference were statistically significant ($p < 0.02$, $p < 0.01$).



1) P>0.001 2) p<0.02 3) P<0.01

Fig. 1. Bound %／alb index in allergic disease, other disease and family of them.

A: Drug allergy, bronchial asthma, allergic rhinitis, urticaria and eczema.

B: Rheumatic fever, acute glomerulonephritis, nephrotic syndrome and juvenile rheumatoid arthritis.

4 Cases (Fig. 2)

The bound % /alb index for some cases will be presented.

In the family A the twins had bronchial asthma and the mother had allergic rhinitis. The father and the first child had no such allergic diseases. The two of these symptomatic persons showed high bound % /alb index (24.4 and 20.8) and other one showed rather normal value (18.9). The first child whose asymptomatic father showed 21.4 had also rather high value, 19.9 .

In the family B, the first child had bronchial asthma and the father had urticaria. The mother and the second child had not suffer from allergic disease so far. The first child whose symptomatic father showed normal value (18.5) had high bound%/alb index (21.4). The asymptomatic mother and second child showed rather high value, 20.9 and 22.6, respectively.

In the family C, the first and second child had drug allergy and the third child had bronchial asthma. The father and mother had urticaria. The index of the mother was 20.2 . The father showed 17.6 . The first, second and third child showed 19.0, 19.5 and 19.1, respectively.

In the family D, the second child and third child had bronchial asthma. The parents and the first child had hitherto shown no allergic disease. The bound % /alb index was 19.7 in the second child and 18.2 in the third child. The first child showed normal bound % /alb index (18.8), even in the case that her father and mother had rather high bound % /alb index.

In the family E, a boy had rheumatic fever. The parents had so far shown no allergic diseases. The boy had high bound % /alb index. His father and mother showed 20.8, 15.9, respectively.

In the family F, the fourth child had juvenile rheumatoid arthritis and showed 19.0 bound % / alb index. Third child showed 15.9. However the other asymtomatic family members showed 24.9 , 22.5, 22.5 and 24.0, respectively.

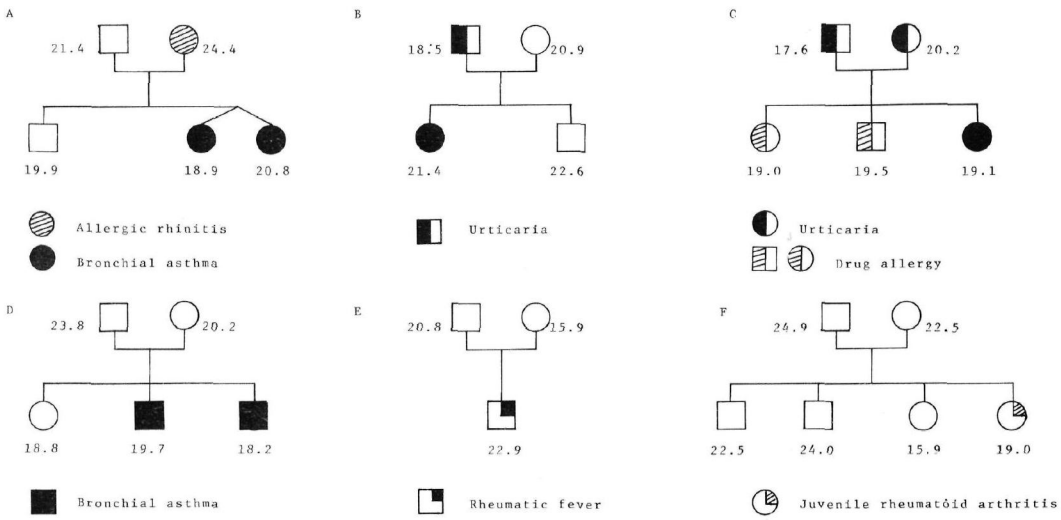


Fig. 2. Pedigrees in the allergic disease and other disease.
The numbers indicate bound% /alb index.

Discussion

It has been considered that allergic disposition had hereditary.

Cook and Vander Veer[2] (1916) showed the existence of a genetical diposition in allergic disease for the first time. Based on the survey of a family trees in 62 cases with hay fever, bronchial asthma, urticaria, angioneurotic edema and certain attacks of acute gastroenteritis. They found evidence of autosomal dominant inheritance.

Bazaral[3] (1971) classified the serum IgE value into three groups, namely high, middle and low groups. They reported that the distribution of three groups was in agreement with the Hardy-Weinberg's law.

From the results of a questionaire to 7,000 twin couples, Edfords-Lubs[4] (1971) stated that the importance of environmental factors should be stressed more in the development of atopic diseases. He also suggested participation of multiple gene as to the form of inheritance.

There is no definite theory as to the form of inheritance in allergic disposition. Maehira[5] (1976) has reported that the concentration of bound salicylate per gram of serum albumin was high in drug allergy and other allergic diseases compared with normal person. He suggested the possibility that serum albumin of patient was different in quality from that of normal individuals and showed high affinity to salicylate. We found high binding affinity of salicylate to serum albumin in drug allergy, bronchial asthma and other type 1 allergic diseases.

Family members of the patients with allergic diseases might have the allergic disposition latently even though they are asymptomatic. The bound % alb index in the Group A family showed high values.

The bound % /alb index was high in other type of allergic diseases, nephrotic syndrome and juvenile rheumatoid arthritis. Those result indicate that such diseases have the same property of serum albumin concerning salicylate binding affinity.

The bound % /alb index in the Group B family was also high. This suggests that not only the Group A family but also the Group B family has the allergic disposition.

The affinity of salicylate to human albumin is high in persons with allergic disposition. This is probably due to difference in quality and structure of albumin[5]. It might be said that high binding affinity of salicylate to human serum albumin was one of biochemical charactristics of allergic disposition. This property of albumin may be useful for screening test of allergic disposition.

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