STUDY ON THE SKIN TEST OF WHOOPING COUGH (III)

S. SOMEYA, Y. KANEKO AND K. UEHARA

Department of Public Health Microbiology, Institute of Public Health, Tokyo

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INTRODUCTION

In our country, there have been many reports on the skin test of whooping cough by agglutininogen¹ and its reliability was discussed by Matsumura³ and the present authors^{2, 4}. In this report, the reliability of this skin test and the relationship between the skin reaction and the susceptibility to whooping cough are examined from the results of the 3 years field study.

The agglutininogen was, as described by Smolens and Mudd¹, prepared from phase I or II *H. pertussis*^{5, 6} grown on Bordet and Gengou medium. The antigen was filtered through Seitz-filter and tested for potency by both in vitro and in vivo methods, and then applied to children. The erythema and the induration were read at the end of 24 hours or 48 hours.

EXPERIMENTAL RESULTS

1. The skin reaction of infants

Shown in Table 1 are the results of the skin test carried on the infants in a rural district which had only few cases of whooping cough for the last few years. The age of the children and infants used in this experiment were from 3 to 26 months and they had no previous history of whooping cough according to the information by their families. As shown in Table 1, the older the children, there were the more positive reactors. In this case the reactions ranged over

Table 1. The skin test on the infant and children (3-26 months old)

Reaction	Age by month	Diameter in mm												Total
		0 1	2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17	18 19	20 over		
Induration after 24 hours	3- 6	10			3		1							14
	7-12	20		2	3	3	8	1	2	1				40
	13-	68	1	2	4	4	13	14	3	1	3	1		114
	Total	98	1	4	10	7	22	15	5	2	3	1		168
Erythema after 48 hours	3- 6	3	2	5	2	1	1							14
	7-12	2	6	14	5	8	5							40
	13-	9	27	25	19	15	5	3	2	2				107
	Total	14	35	44	26	24	11	3	2	2				161

Table 3. The skin test on the primary school children
(Induration after 24 hours)

Class	Diameter in mm																Total	Absent	Cases			
	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30						
	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	over						
1	3					1					3	1	10	4	3	4	2	2	1	34	4	19 (50%)
	4 (11.8%)					30 (88.2%)																
2	4					1	4	9	7	8	6	4	4	5	2	6	60	2	24 (38.7%)			
	4 (6.7%)					56 (93.8%)																
3	5					1	8	2	6	5	6	5	4	4	25	71	4	27 (36%)				
	5 (7%)					66 (93%)																
4	23					1	5	7	10	7	2	2	1	1	3	62	1	4 (6.3%)				
	23 (37.1%)					39 (62.9%)																
5	14					1	1	8	6	7	5	2	3	4	12	63	2	13 (20%)				
	14 (22.2%)					49 (77.8%)																
6	27					1	1	4	12	5	6	4	4	1	2	4	71	1	1 (1.4%)			
	29 (40.8%)					42 (59.2%)																
	76					1	2	6	16	54	34	37	26	20	16	10	13	50	361	14	88 (20.8%)	
	79 (21.7%)					282 (78.3%)																

Table 4. The relationship between the skin reaction* and the apparent infection in the case of the school children

a) In the case of the children having no history and not infected apparently

	Diameter in mm				Total
	0-4	5-9	10-19	20-	
No. of tested	4**		19	8	31
%	13%		87%		

Notes: * Induration after 24 hours

** Erythema after 24 hours; 13, 15, 17 and 17 mm

b) In the case of the children who were infected apparently in this epidemic

	Diameter in mm				Total
	0-4	5-9	10-19	20-	
No. of tested	6*		18	19	43
%	14%		86%		

Note: Erythema after 24 hours; 10, 10, 13, 15, 18 and 21 mm

And the relationship between the skin reaction and the apparent infection was examined on the children who had been home-exposed during this epidemic. As shown in Table 4a, 87% of the children having no so-called history of whooping cough and not infected apparently in this epidemic were positive reactors. This means that they had been already infected inapparently. On the other hand, 86% (37/43) of the children, who had been attacked apparently in this epidemic were positive reactors. The remaining 6 cases, negative reactors judged from the induration after 24 hours, are considered due to the fact that the interval from the beginning of the disease to the skin test was too short to react positively. According to our unpublished data, the patients react positively 3 weeks after onset of the disease. Accordingly, almost all the infected children are considered to become positive reactors.

Furthermore, in the case of Table 4b, it should be taken into consideration that the induration is very difficult to measure accurately. From this point of view, the problem as to whether erythema can be taken as the criterion for the skin reaction or not is a problem for future investigation in spite of the fact that there have been no report based on erythema.

Table 5. The results of the follow-up study for 3 years of the skin test

Group	family	object	skin reaction at Oct. 1951	number of the vaccination	skin reaction at April 1951	attacked
I	A	1	±	4	+	+
		2	+			-
II	B	3	-	4	-	+
		4	±	4	+	+
III	C	(5)				+
		6	-	5	+	+
		7	±	4	±	+
IV	D	8	-	5	±	+
		(9)				+
	E	(10)				+
		11	-	5	+	+
	F	12	-	5	±	+
		13	-	5	+	+
	G	14	+			-
		15	+			-
	H	16	±	4	±	-
	I	17	-	5	±	-
J		(18)		5		+
		19	-	5	+	-
		20	-	4		+
		21	-	5	±	+

3. *The relationship between the skin reaction and the natural infection*

Table 5 shows the results of the follow-up study of the skin test previously reported². The children were attentively observed during Oct. 1950–Sept. 1953. The children listed in Table 5 are either the pertussis patients or the children presumably exposed to them in the home or in the neighborhood. As shown in Table 5, all of the patients had been negative or doubtfully positive (5–9 mm.) reactors. Although they were inoculated with pertussis vaccine and some of them became positive reactors, they were apparently infected at the end of 1950. It seems very difficult to discuss the relationship between the immunity and the skin reaction in the case of the children inoculated with pertussis vaccine, because the interval from the skin test to the infection was about 6 months and during which period there might be the decrease of immunity and the negative conversion of the skin reaction.

It is to be noted in Table 5 that 3 positive reactors who received no vaccination had experienced no attack of whooping cough. Conclusively, the susceptibility of negative reactors and the immunity of positive reactors are considered to be confirmed in the natural epidemic. This observation is still undergoing, but will be complemented in near future.

DISCUSSION

It goes without saying that the reliability of the skin reaction should be examined on the children having the history and not having the history of the disease. But in the field, it is almost impossible to know accurate history.

The examination results shown in Table 1 may be the best of the skin reaction in the field on the young infant who were considered to be susceptible to whooping cough. On the other hand, it is considered almost impossible to examine the reliability of the skin reaction on the children having so-called history, because not all the children are diagnosed by the physician and based on the bacteriological examination. Regarding to this point, refer to reference (8).

Thus it is very difficult to correlate the history and the skin reaction, and the discrepancy to some extent between them seems unavoidable in the case of the field study. Such an observation as shown in Table 5 will be most important to examine the reliability of the Skin Reaction.

CONCLUSIONS

1. A total of 600 children, who were tested previously by the skin reaction, had been observed for 3 years, and 17 cases outbreaked from them. These 17 cases were all negative reactors and the positive reactors exposed to them escaped the infection.

2. Two groups, the young infant and the children of school age, were tested by the same Lot of agglutininogen. And it was confirmed that the percentage of positive reactors of each group was noticeably different and there were more inapparent infections in the children of school age than the young infant.

3. A total of 109 infants were tested of their skin reaction before and after vaccination and the percentage of positive reactors was lower than that of Felton *et al*. From this point, it is supposed that the immunizing potency of pertussis vaccine in Japan might be inferior to that of the U.S.A.

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