

## THE DICK TEST IN SCARLET FEVER PATIENTS AND IN NORMAL INDIVIDUALS.

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SINCE Dick and Dick (1924) published their method of testing the susceptibility or insusceptibility of human beings to scarlet fever various other workers have reported investigations which have confirmed the observations of the Dicks.

Zingher (1924 *a—d*) found that 98 per cent. of cases of scarlet fever gave a positive reaction with the Dick test during the first five days of the disease, while during convalescence 19 per cent. of cases still showed a positive reaction. He believed that the Dick test was a reliable index of immunity and susceptibility to scarlet fever and was of opinion that, when a strongly positive Dick test was obtained in a patient ill for five or six days, the positive reaction should be regarded as evidence against the patient having had scarlet fever. Branch and Edwards (1924) tested sixty-five convalescent cases of scarlet fever and found that all gave negative Dick tests. Dick and Dick (1925) in a series of 204 patients who had previously had scarlet fever found that 9.3 per cent. reacted positively. Rosen and Korobicina (1925) reported that they had studied the Dick test in 123 cases of scarlet fever and found that 82.5 per cent. were positive on the second day of the disease, 74.1 per cent. on the fourth day, 50 per cent. on the fifth day and 17.2 per cent. during convalescence. Kerr (1925) and co-workers tested 441 cases of scarlet fever and obtained positive reactions in 73.7 per cent. of cases during the first three days of the disease and in 7.3 per cent. of cases during convalescence, while O'Kell and Parish (1925) in 120 convalescent cases obtained positive reactions in 18 per cent. of cases. Brown (1925) tested the reactions of scarlet fever cases with two dilutions of toxin, 1 in 6000 and 1 in 1000. With the 1 in 6000 toxin only 26.6 per cent. of thirty cases of acute scarlet fever gave a positive reaction, while with toxin diluted 1 in 1000 seven acute cases all gave positive reactions. In ninety patients with a history of having had scarlet fever or convalescing from scarlet fever 8.8 per cent. of cases gave a positive reaction with toxin diluted 1 in 6000, while in twenty-five convalescent cases tested with 1 in 1000 dilution positive reactions were obtained in 32 per cent. of cases.

The largest series of Dick tests applied to normal individuals has been presented by Zingher (1924 *d*). He found that the Dick test corresponded closely with the Schick test as regards the age incidence of susceptibility. In 7700 cases tested, 44.8 per cent. of children under six months gave a positive reaction, 71.6 per cent. were positive in the 1 to 2 years period, 33 per cent. were positive at 10 years of age while after the 20 years period the per-

centage of positive reactions diminished to 14.4 per cent. Branch and Edwards (1924) tested eighty children varying in age from 2 to 11 years and found 40 per cent. positive. Dick and Dick (1925) tested a total of 654 individuals of varying ages and obtained positive reactions in 24.6 per cent. Nesbit (1925) applied the Dick test to 2162 individuals, mainly children and young adults, and found 40 per cent. positive. Rosen and Korobicina (1925) tested 187 healthy beings and found the most susceptible age period was from 2 to 8 years. Kerr (1925) found in 442 individuals that the Dick test was most often positive in the 2 to 10 years period of life and obtained the greatest number of positive reactions in children between the ages of 2 and 3 years.

#### THE AUTHORS' INVESTIGATIONS.

##### *Preparation of Toxin.*

The toxin used during the first part of our investigation was obtained by growing a strain of *S. scarlatinae* in 2 per cent. sheep blood broth for four days. Later, as a result of the work of O'Kell and Parish (1925), Hartley's trypsin broth was used and the incubation period was reduced to 24 hours. Various types of Chamberland, Berkefeld and Seitz filters were employed to obtain the germ-free soluble exo-toxin with equal success. The toxin was standardised by comparing the reactions produced, by various dilutions, on normal children, on acute cases, and on convalescent cases of scarlet fever. The actual test dose varied between 0.2 c.c. of 1 in 1000 dilution of one toxin to 0.2 c.c. of a 1 in 2000 dilution of another. Before using a new toxin the reactions obtained with various dilutions of this toxin were compared with the reactions produced by the original toxin in the same individuals so as to ensure a considerable degree of uniformity. The reactions were controlled by using the diluted toxin which had been destroyed by heating at 100° C. for 1 hour.

##### *Results.*

The results obtained with the Dick test in cases of scarlet fever may be summarised as follows:

Day of disease	1-2	3	4	5	6	7-14
Total number tested	58	40	30	17	7	18
Number positive	50	28	18	9	3	5
Number negative	8	12	12	8	4	13
Per cent. positive	86.3	70	60	52.9	42.8	27.7

It will thus be seen that a large percentage of positive reactions were obtained in the first two days of the illness and that the percentage of positive reactors rapidly decreased. During the fourth week of the disease 158 of these patients were retested and 14 per cent. were found to react positively. It was noted that there was some degree of correlation between the intensity of the reactions obtained at the beginning of the illness and the reaction obtained in the fourth week of the disease. That is to say a case which gave a strong positive reaction on the first or second day was much more likely to be still

positive in the fourth week than a case which gave a weak positive in the initial stages.

Normal individuals, 267 in all, who gave no history of scarlet fever were tested with the following result:

Age in years	6/12	1	2	3	4	5	6	7	8	9	10	11-15	15-20	20-
Number tested	11	7	19	9	7	10	5	6	11	11	13	30	33	95
Number positive	2	4	16	8	6	6	2	5	2	4	8	10	14	26
Number negative	9	3	3	1	1	4	3	1	9	7	5	20	19	69

Thus in the age period under six months only 20 per cent. gave a positive reaction, from six months to 5 years 77 per cent., in the 6 to 10 years period 46 per cent., in the 10 to 20 years period 38 per cent., while in the group 20 years and upwards 27 per cent. still gave a positive Dick reaction.

In a series of sixty individuals who gave a definite history of having had scarlet fever and who consisted for the most part of the nursing and domestic staff of the hospital nine individuals gave a positive reaction. The reactions were mainly slight in character, only one individual, who was supposed to have had scarlet fever forty-four years previously, giving a markedly positive Dick test.

#### *Remarks.*

Further evidence of the value of the Dick test as a guide to the susceptibility of individuals was also obtained by testing the nursing staff and patients in wards in which cross infection with scarlet fever had taken place. In this way scarlet fever has been observed to occur in ten patients who previously showed a positive Dick reaction. On the other hand numerous cases (notified as scarlatina) were admitted to the scarlet fever wards with no definite clinical sign of the disease and when found to be Dick negative were allowed to remain in contact with other scarlet fever cases. In no single instance was a case of scarlet fever found to follow. In three instances cases were admitted in the third or fourth week of illness with definite desquamation and appeared clinically to have had a typical attack of scarlet fever. The Dick test in all three cases was markedly positive on admission, and all developed a second attack of the disease.

In certain of those cases in which the Dick test had been carried out during a period of two to three weeks prior to the attack of scarlet fever, the area on the forearm corresponding to the previous reaction again became intensely red as compared with the rash on the surrounding skin. It has also been observed that the intensity of the reaction is of much significance and in the present investigation scarlet fever has only been found to occur in individuals giving a marked Dick reaction. It is thus probable that numerous individuals regarded at present as susceptible will later be eliminated when further investigation has been made of the immunity mechanism in scarlet fever and when a method of more accurate standardisation of the toxin has been evolved. The future, however, will undoubtedly see the Dick test in relation to scarlet fever as firmly established as the Schick test is in relation to diphtheria.

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