A NOTE ON MANTOUX SENSITIVITY IN SICK CHILDREN

BY

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The Mantoux test is of peculiar value to the clinical paediatrician, for a positive reaction often decides a diagnosis in favour of tuberculous disease. The chief drawback to the test is that the significance of a positive reaction is not a constant. The incidence of active disease among positive reactors varies with the age and background of the patients; it varies also from country to country, from town to town, and probably from decade to decade. When a sick child in hospital is found to have a positive Mantoux the weight to be given to that finding must be judged against the background of the Mantoux state of the particular hospital's child population. Each paediatric unit must form its own criteria and adjust these from time to time. In the case of our own department the figures are weighted by a special interest in tuberculous meningitis and by the exceptionally good general health of the children in our region.

This note records a simple method of assessing the significance of the reaction for clinical purposes among children admitted to our wards.

Methods

Every child admitted is tested for tuberculin sensitivity. On admission a controlled jelly test is applied in the scapular region of the back. The jelly used contains 60% v/w old tuberculin. The skin is cleansed with acetone or with methylated ether; the jelly is applied direct and covered with strapping. The strapping is removed after 48 hours and the reading is made after a further 48 hours. A Mantoux test is also made by injecting 0.1 ml. of 1:1,000 old tuberculin into the skin of the palmar surface of the forearm. Particular care is taken to ensure that a true intradermal injection is made.

The response to these tests is recorded in a book kept in every ward. The following facts are noted about each child: (a) Name and hospital number; (b) age at the time of testing; (c) response to 1:1,000 Mantoux; (d) response to jelly test; (e) final diagnosis reached; (f) evidence of active tuberculous disease; (g) history of past tuberculous disease; (h) evidence of healed tuberculous disease; and (i) history of contact with tuberculous infection.

From these facts tables are made quarterly and yearly, showing the relationships between positive and negative reactions, age, diagnosis, and presence or absence of active or inactive tuberculosis. These tables then form a background against which to judge the significance of the test in a given case.

Results

The results of testing a consecutive unselected sample of 836 children admitted to our wards between May, 1949, and July, 1950, are given.

Of the 836 children, 39 (4%) were not tested, because they had been discharged or had died within 48 hours. There remain 797 cases for analysis.

Fig. 1.—Incidence of positive reactors in two-year age groups.

Fig. 1 shows the incidence of positive reactors in each two-year age group. The columns are divided to show the percentage of positive reactors with and without evidence of active tuberculosis. A small number of the positive reactors had had previous known tuberculous disease; the remainder were assumed to have passed through a silent conversion. It will be seen that the incidence of silent conversion rises with age, but even in the oldest group it does not exceed 27%. Fig. 2 and the Table show the distribution in terms of three age groups: 0-3 years, 3-7 years, and 7-14 years. Of 271 children under 3 years, only three whose reactions were positive lacked evidence of active tuberculosis. Two of these had previously been under treatment for active disease, leaving one child among the 20 positive reactors in this age group who had undergone conversion without a diagnosed tuberculous illness.

Below the age of 3 years, 85% of positive reactors had active tuberculosis at the time of the test. Between the ages of 3 and 7 years, although the overall incidence of positive reactors rose to 18.3%, the incidence of active disease in those positive was still 81%. Thus demonstrable active tuberculosis was present in more than four-fifths of our patients under 7 years who had positive reactions. Over the age of 7 years there was a sharp change. The significance of a positive reaction was, in fact, almost exactly inverted compared with the younger group. Only 28% of those over 7 with positive reactions had active tuberculosis, whilst in 72% the infection was presumed healed or latent.

The age of 7 was of course chosen arbitrarily as a convenient dividing line, but there was, in fact, a sudden sharp rise in the incidence of inactive positive reactors at this age. It therefore seems that in our particular hospital population a positive Mantoux reaction in those under 7 years demands a very careful search for active disease, and that this search is rewarded in most cases.

All children who have converted at this early age should clearly be followed for a number of years. It is our practice to send the names of these early converters, even if they lack active disease, to the tuberculosis authority so that their families may be investigated. The source of the infection in small children is usually within the home, and it is hoped that liaison between children's departments and tuberculosis officers

FIG. 2.—Percentage of positive reactors, with and without evidence of active tuberculosis, in three age groups.

Age	No. Negative	No. Positive	Positive with Active T.B.	Positive but Inactive	% Active of All Positive	Total Tested
0-3	251	20 (7.3%)	17	3 (1.1%)	85	271
3-7	209	47 (18.3%)	38	9 (3.5%)	80.8	256
7-14	198	72 (26.6%)	20	52 (19.2%)	27.9	270
Totals	658	139	75	64		797

may be an economical method of case-finding among tuberculous parents.

The figures collected by the method described are intended chiefly to provide criteria for judging the significance of a positive Mantoux reaction within a certain group of children at a given time. The records do, however, promise to provide facts of more general application. Some of these points are briefly mentioned.

Negative Reactions.—In this sample of 797 sick children there was no case in which active tuberculosis was associated with a negative reaction to a 1:1,000 Mantoux. There is no doubt that such reactions do occasionally occur—for example, towards the end of an overwhelming tuberculous infection and during certain exanthemata—but they are rare and detract little from the value of the tests in clinical paediatrics.

Severe Reactions.—We have seen severe necrotic lesions following Mantoux-testing in small hypersensitive children. The initial jelly test acts as a safeguard against this danger. In addition, since the 1:1,000 dilution appears to give accurate results, we avoid, so far as is possible, the use of the 1:100 and 1:10 dilutions.

Jelly Testing.—In our wards we have occasionally met a succession of negative jelly tests among Mantoux-positive children. These failures have usually been

traceable to a batch of jelly kept too long before application. It is now our practice to test any suspect batch on the skins of children known to be sensitive to tuberculin. The jelly test seems to be reasonably accurate: of 139 children reactive to the 1:1,000 Mantoux, more than 90% were positive to the jelly. With an accuracy of this order the jelly forms a useful control against the occasional lapse in the technique of setting up and reading the Mantoux test.

The Period of Safety

McDougall (1949) has stressed the remarkable freedom from manifest tuberculosis that occurs in that "period of safety"—the years about puberty. This feature is evident even in our highly selected hospital population. Comparison of age group 12-14 with group 10-12 in Fig. 1 illustrates this point: although the incidence of silent conversion rose from 13 to 27%, the older group yielded no cases of active tuberculosis, whilst in the younger group half the positive reactors had active disease.

This period of safe conversion marks also the upper age limit of our children, so that the group is bounded at the lower end by an age group in which tuberculous infection appears almost always to result in manifest disease, and at the upper end by a group of high resistance.

Summary

A simple method of recording the results of routine Mantoux tests on sick children is described.

The method and results are illustrated by an analysis of 836 consecutive admissions.

In more than four-fifths of those under 7 years a positive reaction was associated with active tuberculosis. Only one example of silent conversion was found among 271 sick children under 3, 20 of whom were positive reactors.

Only 28% of all positive reactors over 7 years had active disease.

A negative reaction to 1:1,000 Mantoux, with a negative reaction to a jelly test as an additional safeguard, is likely to exclude, for practical purposes, all cases of active disease in this age group.

It is suggested that the weight given to a positive Mantoux reaction in a sick child demands a knowledge of the Mantoux state of one's own patients as a whole. The routine testing of all patients, and the regular analysis of the results obtained, provide a rational framework for clinical judgment. Each centre must, however, form its own criteria of significance and make appropriate adjustments from time to time.

Our thanks are due to Dr. Hugh Ellis for permission to include his patients in this series, and to successive house-physicians in the children's wards for their conscientious recording of the data on which this note is based.

REFERENCE

McDougall, J. B. (1949). *Tuberculosis: a Global Study in Social Pathology*. Livingstone, Edinburgh.

The largest prefabricated timber house ever exported from Sweden, a hospital unit with a length of 250 metres, will shortly be shipped by Amals Sagverks AB to the city of Poitiers, France. The hospital, which will accommodate 250 in-patients, also includes operation-ward, kitchen, dining-rooms, and lounges, also staff quarters and a chapel. No less than 75 standard railway cars are required for transporting the materials by land.