

BCG – A Diagnostic Tool in Childhood Tuberculosis

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Summary

114 cases of tuberculosis in children are reported. The age range, sex distribution and type of tuberculosis alongwith laboratory investigations are described in detail. A comparison of Mantoux test and BCG has been the purpose of this study. The techniques and the detailed criteria of positive response have been described. The results show that the BCG positivity (70.02%) was much more than the Mantoux positivity (49.12%). Literature has been reviewed extensively. Various observations and conclusions have been drawn in favour of BCG testing. Finally it has been emphatically recommended to the medical workers that BCG should be used in diagnosis and prophylaxis without danger of any adverse reaction.

Introduction

BCG has been used extensively in the prophylaxis against tuberculosis in children since it was manufactured for this purpose. Its use in paediatric practice, from birth till adolescence, is well-established and needs no further elaboration.¹ Besides its prophylactic use, BCG has been tried in immunotherapy of some malignancies with varying and controversial results.² In the last decade paediatric workers in the field of childhood tuberculosis from India have drawn attention to the use of BCG vaccine as a diagnostic tool in tuberculosis of children.^{3,4} Long before the Indians, the western scientists had already emphasized the diagnostic value of BCG for detection of tuberculous allergy.^{5,6}

The comparison of Mantoux test versus BCG test in the Western and Indian studies have been very striking and helpful in the diagnosis of tuberculosis. This has prompted us to use BCG as a diagnostic aid in childhood tuberculosis in Pakistan for the first time. This study was done on the style of Udani³ and Chaudhry.⁴ We have done this study to compare our results with the Indian workers and to see the usefulness of BCG as a diagnostic tool in children with tuberculous infection.

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Material and Methods

This study was carried out in the department of Paediatrics, Postgraduate Medical Institute/Lady Reading Hospital, Peshawar extending over a period of 1½ years. 114 children ranging in age from 4 months to 11 years suffering from tuberculosis were included in the study. The diagnosis of tuberculosis in each patient was established on the basis of detailed history, clinical examination, radiological surveys and laboratory investigations. These investigations included F.B.C. with E.S.R., sputum or gastric aspirate examination for A.F.B., C.S.F. examination in cases of T.B. meningitis and pleural aspirate examination in cases of pleural effusion. Lymph node and bone biopsy was carried out where indicated. Radiological examination of chest was done in each case, while X-rays of other parts of the skeleton were done where indicated: like hip joint and spine etc. Tuberculin and BCG tests were done concurrently in the same patient. For BCG skin test, 0.1ml of fresh solution of freeze-dried BCG vaccine was injected in the left deltoid region. For the tuberculin test, 0.1ml of 5 T.U. of P.P.D. was injected intradermally in the right fore-arm. One T.U. solution of P.P.D. was not used in this study because it is not reliable in the demonstration of tuberculous allergy in malnourished children.⁴ 10 T.U. tuberculin test was used in those severely malnourished children who had a negative response to 5 T.U.

The criteria for a positive Mantoux test were used as described by the Red Book of the American Academy of Paediatrics.¹ The criteria for a positive BCG test were taken from the various studies of Udani.^{3,7} A positive BCG meant an accelerated reaction to complete healing in 10–15 days, instead of a normal reaction in 7–10 weeks. The following criteria were used at various intervals :—

48–72 Hr.....	5–9mm.....	Mild (1+)
48–72 Hr.....	10–20mm.....	Moderate (2+)
48–72 Hr.....	21–30mm.....	Severe (3+)
5– 8 days.....		Pustule formation
10–15 days.....		Healing with scab formation

Results

The final analysis of 114 cases of different types of tuberculosis is given in Table I. Both pulmonary and extra-pulmonary tuberculosis are grouped together. Over 1/3rd of the total admissions (35.08%) were due to tuberculous meningitis. This is comparable to our own previous study⁸ and other studies.⁹ These children were usually very ill and admitted in emergency. Another major

TABLE I
TYPES OF TUBERCULOSIS

Types of Tuberculosis	No. of Cases	Percentage
T.B. Meningitis	40	35.08%
Pulmonary T.B.	23	20.17%
Primary Complex	6	5.26%
T.B. Adenitis	4	3.5 %
Miliary T.B.	3	2.6 %
T.B. Consolidation	9	7.89%
T.B. Pleural Effusion	8	7.61%
T.B. Abdomen	7	6.14%
T.B. Hip Joint	1	0.87%
T.B. Osteomyelitis (Thumbs)	1	0.87%
T.B. Pericardial Effusion	1	0.87%
T.B. Pyopneumothorax	1	0.87%
T.B.M. + Pl. Eff.	1	0.87%
Pul. + Abd. T.B.	3	2.6 %
Pul. + T.B.M.	3	2.6 %
Spine + L. Node T.B.	1	0.87%
Consolid. + L. Node T.B.	1	0.87%
Spine + Pulmonary T.B.	1	0.87%
TOTAL	114	

group was of pulmonary tuberculosis, tuberculous pleural effusion and consolidation (35.5%). Besides tuberculous meningitis, other types of extra-pulmonary tuberculosis were due to tuberculosis of lymph glands, abdomen, bones and joints. Miliary tuberculosis was seen in 2.6%. Out of 114 cases, 48 were female (42.3%) and 66 were males (57.7%). The age range was from 4 months to 11 years. Majority of the patients (61.4%) were of pre-school age i.e. 1-6 years.

Table II shows the comparison of Mantoux test versus BCG test. 56 children had a positive Mantoux test (9.12%). In all these cases, BCG was positive as well. Out of the remaining 58 cases, who had a negative Mantoux test, 24 (21.05%) had a positive BCG in addition, indicating better detection (by BCG) of hypersensitivity to tuberculosis. Most of the patients in this group, who had a negative Mantoux but a positive BCG, were severely diseased and malnourished. These are the types of cases which are missed by Mantoux testing even though they are tuberculous. BCG was positive in a total of 80 cases, giving a positivity rate of 70.02%. In 34 cases (29.82%), both Mantoux and BCG

TABLE II
COMPARISON OF POSITIVITY
MANTOUX VERSUS BCG TEST

Mantoux/BCG Positivity	No. of Cases	Percentage
Mantoux Positive	56	49.12%
Both Mantoux and BCG Positive	56	49.12%
Additional BCG Positive	24	21.05%
Total BCG Positive	80	70.02%
None Positive	34	29.82%

were negative indicating complete suppression of hypersensitivity inspite of active tuberculosis. Complications were seen rarely in this study. Slight enlargement of the axillary lymph nodes was seen in 2 cases and marked hypertrophy of the axillary lymph nodes was seen in only one case.

Discussion

This study confirms that BCG skin test is more sensitive than Mantoux test in the detection of tuberculin allergy in patients with tuberculosis. This has been reported in Indian medical literature.^{3,4,7} In Pakistan we claim this to be the first publication of the use of BCG as a diagnostic test. The adverse reactions of BCG are minimum as reported by the WHO publications and Indian workers.^{4,10, 11}

We have found that the following suggestions of Udani were very helpful in our cases¹¹ :- '1+' or more positive BCG in non-vaccinated children particularly under 5 years means infection; '2+' and '3+' BCG in vaccinated patients under 5 years of age means infection. We also found this to be true in the pre-school age group i.e. under the age of 6 years. Most of our positive BCG showed an induration of 10–15mm, presence or absence of pustule/vesicle and completion of the whole process in 10–15 days. Like other studies, we also found that BCG was more often positive in malnourished and severely diseased children.

We are strongly impressed by the use of BCG in children and on the basis of our observation, we would like to conclude and give the following recommendations to our colleagues in the medical profession in Pakistan :-

1. BCG is more helpful as a diagnostic tool as compared to Mantoux test.
2. Besides its diagnostic value, it still continues to be the only prophylactic measure against tuberculosis.

3. Being safe, it can be given at any age including the newborns.
4. It can be safely administered to any individual at risk without a prior Mantoux Test.
5. BCG can be safely administered to malnourished and severely infected children, serving both diagnostic and prophylactic purpose.
6. Even in vaccinated children, BCG can be safely used as a diagnostic tool to look for accelerated allergy in disease.

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