

Comparison of diagnostic BCG Test with Mantoux Test in Children with Suspicion of Tuberculosis

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The incidence of TB is increasing at an alarming rate in Pakistan as indicated by WHO 1997. The BCG test has been proved as a rapid, reliable and cost-effective test in children in many international studies. The BCG test has superiority over Mantoux test in children with severe malnutrition and TBM. The BCG test was positive in (80%) patients while Mantoux test was positive in 50% patients. The BCG test was positive in all patients where Mantoux test was positive. Thirty one patients had BCG test positive where Mantoux test was negative. Majority of the patients with positive BCG test (85%) were severely malnourished while Mantoux test was positive in only 15.6% of such cases. Most of BCG test positive children were below 5 years of age. In Tuberculous meningitis (TBM), BCG test was more (86%) conclusive than Mantoux test (14%). All patients with positive Mantoux test also had positive BCG test. In pulmonary TB, 40 (91%) patients were BCG test positive as compared to positive Mantoux test (45%). All patients with positive Mantoux test also had positive BCG test.

Key words: BCG, TB, Mantoux test

Tuberculosis remains the most important chronic infectious disease in terms of morbidity, mortality and cost. The TB is caused by a group of microbiologically similar bacilli, the most important of which is *Mycobacterium Tuberculosis*¹. Tuberculosis kills about 3 million people a year, including 300,000 children under 15 and is producing 7,000 deaths and over 24,000 new cases every day².

In most developing countries including Pakistan, the present risk of infection with TB is 20-25 times higher than the developed countries³. Various etiological factors particularly poverty, malnutrition, other communicable diseases, lower vaccination rate and lack of health awareness lead to this higher rate of infection. Tuberculosis is a serious health hazard in Pakistan, 1.5 million suffer from TB and more than 210,000 new cases occur each year⁴. The prevalence surveys conducted in Pakistan in 1960-62 and 1974-78, showed infection rate in children from 0-14 years of age 25% and 22% respectively. About 1.6% of the population above 10 years of age had chest radiograph suggestive of active pulmonary TB and 0.3% were sputum positive on microscopy and/or culture⁵.

The definite diagnosis of TB is often difficult in children, moreover, it is very difficult to isolate the M.TB from various secretions and tissues of paediatric patients. Usually the diagnosis of TB in children is often based on epidemiological, clinical, radiographic findings and skin tests instead of isolation of mycobacterium which remains gold standard for the diagnosis of TB in adults⁶.

Mantoux test is a traditional method of demonstrating mycobacterial infection, however, it has some limitations such as high false negativity rate in severe forms of TB such as tuberculous meningitis, miliary tuberculosis, measles, severe malnutrition and immunosuppressed states. During the last many years, new diagnostic

modalities have been evolved and main emphasis had been to find out rapid diagnostic tools for the diagnosis of TB. Majority of these tests are not available for routine use in the community and also are very costly.

BCG test is especially useful in conditions where Mantoux is false negative such as severe malnutrition, military TB and TBM⁷. It can be used as a rapid diagnostic test for TB in situations where the condition of the serious and the diagnosis has to be made rapidly. In our set-up, we lack most of the rapid diagnostic tests like Bactec test and PCR. Majority of the patients belong to low socioeconomic group and are usually malnourished. In such situations BCG test can be used as an alternative, rapid, reliable and cost effective diagnostic test. So this study was designed to compare the BCG test with Mantoux test for the diagnosis of TB in children with suspicion of tuberculosis.

Aims and objectives

To compare the diagnostic efficacy of BCG test with Mantoux test in children with suspicion of tuberculosis.

Material and methods

During a period of one year, a total of 100 patients coming to paediatric department OPD or admitted having suspicion of TB and who had not been vaccinated for Tuberculosis were included in the study. Patients of age more than 15 years and those who were vaccinated with BCG vaccine were excluded from the study.

A thorough history was taken and physical examination of all the patients was done. Investigations done in patients were:

1. Hb, TLC, DTC with ESR in all cases.
2. Chest X-ray and X-ray of other parts of body as required.
3. Abdominal USG and Cranial USG where required.

4. Lumber puncture and examination of CSF was done in patients with suspected TBM.
5. Lymph node biopsy in suspected cases of TB lymphadenitis.
6. CT SCAN Brain in case of TBM.

BCG Test: This test was carried out in all patients by injecting 0.1ml of freeze dried BCG vaccine over the deltoid muscle on the left shoulder intradermally. BCG test results were noted between 48-72 hours. The criteria used for positive BCG test were taken from various studies of Udani and Imran. Induration more than 5 mm in diameter was taken as positive and results were graded as:

Mild positive	5-9 mm induration.
Moderate positive	10-20 mm induration.
Strongly positive	>20 mm induration.

Mantoux Test: All patients were given 0.1 ml of PPD (5units) on the volar surface of the forearm intradermally. The criteria for positive Mantoux test was used as described by Red book-1982. The results were read between 48-72 hours and were graded as:

Doubtful positive	6-9 mm induration.
Positive 1+	10-14 mm induration
Positive 2+	15-19 mm induration
Positive 3+	20-30 mm induration
Positive 4+	>30 mm induration

Results

A total of 100 patients were studied. Out of them 55 were male and 45 were female (Table 1). Eighty three patients were malnourished. Out of these, 32 were in first degree malnutrition, 19 patients had 2nd degree malnutrition and 32 patients had severe malnutrition. Majority of the patients were (57) were below 5 years of age (Table 2), out of which 28 were severely malnourished. Regarding the

various types of tuberculosis, 31 patients had lymphadenopathy, 44 had pulmonary TB including 3 cases of military TB, 14 cases of TBM, 7 cases of abdominal TB and 4 cases of bone and joint (Table 4).

Table 1. Sex distribution

Sex	n=	%age
Male	55	55
Female	45	45
Total	100	100

Table 2. Age distribution

Age	n=	%age
0-1 year	20	25
01-05 years	37	37
05-10 years	29	29
>10 years	14	14

Prolonged fever & cough of more than 2 weeks duration were present in 86% and 56% of the patients respectively. Contact with a tuberculous patient was positive in 78 and chest X-ray was suggestive in 69 patients. Out of 100 patients, BCG test was positive in 81 patients and was negative in 19 patients. Mantoux test was positive in 50 patients and was negative in 50 patients. Both BCG test and Mantoux test were positive in 50 patients. 31 patients had a positive BCG test and a negative Mantoux test. Both tests were negative in 19 patients, out of them 9 patients had lymph node biopsy positive for TB, 2 patients had suspected TBM with neurological deficit and hydrocephalus on cranial USG & CT SCAN Brain and 4 patients had pulmonary TB with good response to ATT. In TB Lymphadenitis, BCG test was positive in 22/31(71%) patients while Mantoux test was positive in 21/31 cases (67%). In Pulmonary TB, the BCG test was positive in 40/44 cases (90%) as compared to Mantoux.

Table 3 Comparison of BCG test and Mantoux test in malnutrition

Test	Total	N	I	II	III
BCG +Ve	81	12(14.8%)	25(30.9%)	17(21%)	27(33.3%)
Mantoux +Ve	50	11(22%)	22(44%)	12(24%)	5(10%)
Both +Ve	50	11(22%)	22(44%)	12(24%)	5(10%)
Both -Ve	12	5(26.3%)	7(36.8%)	2(10.5%)	5(26.3%)
BCG +Ve, Mx -Ve	31	1(3.2%)	3(9.7%)	5(16.1%)	22(70.9%)
BCG -Ve	19	5(26.3%)	7(36.8%)	2(10.5%)	5(26.3%)
Mx -Ve	50	6(12%)	10(20%)	7(14%)	27(54%)
	P<001	P<001	P<001	P<.123	P<0.4

Table 4 Comparison of BCG test and Mantoux test in different types of tuberculosis

System	Total	BCG+VE	Mx+VE	Both+VE	Both-VE	BCG +VEMx -VE
Lymphadenitis	31	22(71%)	21(67%)	21(67%)	9(29%)	1(3.2%)
Respiratory System	44	40(90.9%)	20(45.5%)	20(45.5%)	4(9.1%)	20(45.5%)
TBM	14	12(85.7%)	2(14.3%)	2(14.3%)	2(14.3%)	10 (71.4%)
Abdominal TB	7	5(71.4%)	5(71.4%)	5(71.4%)	2(28.6%)	0
Skeletal TB	4	2(50%)	2(50%)	2(50%)	2(50%)	0
Total	100	81	50	50	19	31

test 20/44(45%).In Miliary TB,BCG test was positive in all 3 cases(100%) while Mantoux test was positive in one case, all were malnourished. In TBM, BCG test was positive in 12/14 cases (85%) while Mantoux test was positive in 2/14 cases (14%).In abdominal TB, both BCG and Mantoux test were positive in all 5 cases. In bone & joints TB, both BCG and Mantoux test were positive in 2/4 cases

Most of the BCG test positive patients (50) were below 5 years of age (61%) and 69 had malnutrition (85%). Twenty seven patients were severely malnourished (85%). Mantoux test was positive only in 5 patients who were severely malnourished and all 5 patients also had positive BCG test. Both tests were negative in only 5 cases of severely malnutrition. In cases where Mantoux test was negative and BCG test was positive, 30 were malnourished (97%) and 24 were severely malnourished (77%) (Table 3).

The BCG test was negative in 19 patients, only 5 had severe malnutrition and majority were more than 5 years of age. The Mantoux test was negative in 50 patients, 44 had malnutrition (88%) and 27 were severely malnourished (84%). Most of the patients were below 5 years of age.

Discussion

The BCG test has been shown to have an edge over Mantoux test for the diagnosis of TB. The present study also favours the superiority of BCG test over Mantoux test in children. It has been shown to be more effective in severe malnutrition & neurotuberculosis.

Out of 100 patients, 55 were male and 45 were female. Imran(1987) showed 57.7% male and 42.3% female. Majority of patients in present study were of respiratory TB (44%) and tuberculous lymphadenitis (31%).In the study by Imran (1987) patients were mainly of respiratory TB (43.9%) and TBM (40%).In the present study , 57% patients who had positive BCG test and negative Mantoux test were below the age of 5 years which favours the results shown by Imran (1987).

In this study BCG test was positive in 81% patients while Mantoux test was positive in 50% patients. Imran (1987) showed BCG test positivity in 70% & Mantoux test positivity in 49% patients. Udani (1971) showed BCG test positivity in 88% patients and Mantoux test positivity in 52% patients, also shown by Velhal et al 1991.

The BCG test was positive in all patients where Mantoux test was positive. Thirty one patients had BCG test positive where Mantoux test was negative. Imran (1987) showed 100% BCG test positivity where Mantoux test was positive and 21% had positive BCG test where Mantoux test was negative.

The BCG test was positive in 85.2% patients with malnutrition and in 84.4% patients with severe malnutrition. Majority of the patients with severe malnutrition and positive BCG test were below 5 years of

age. Mantoux test was positive in only 5 patients with severe malnutrition and all of these patients also had positive BCG test. In cases of positive BCG test and negative Mantoux test, 30/31(97%) were malnourished and out of these 24(77%) had severe malnutrition. The BCG test was negative in 19 patients, most were more than 5 years of age (70%) &only 5 had severe malnutrition, also shown by Imran and Gocmen et al.

In TBM, 13/14 were malnourished (92%) and BCG test was positive in 12/14 cases (85%) while Mantoux test was positive in two cases (14%).Both patients with positive Mantoux test also had positive BCG test. In respiratory TB, BCG test was positive in 40/44 cases (91%) while Mantoux test was positive in 20/44 cases (45%). All patients with positive Mantoux test also had positive BCG test.

Majority of cases (78) were not the confirmed cases of TB due to non-availability of most of the newer sophisticated tests as well as resources. The complications of BCG test were seen only in 5 patients, 3 cases had localized abscess formation and axillary lymph node enlargement in 2 cases on same side. All recovered without treatment.

Conclusions

1. This study shows a better positivity with the BCG test than Mantoux test in children with various forms of TB.
2. BCG test positivity is much more in malnourished children, especially in severe malnutrition and in children of younger age group (less than 5 years)
3. Pulmonary TB and Tuberculous meningitis also have high BCG test positivity (90%) as compared to Mantoux test positivity (38%).

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