

ORIGINAL ARTICLE

COMPARISON OF POSITIVITY OF TUBERCULIN SKIN TEST WITH DIAGNOSTIC BCG IN CHILDREN SUFFERING FROM TUBERCULOSIS

Tariq Alam, Zaheer Abbas*, Saima Gillani*, Syed Hassan Mustafa**, Syed Maisam Ali***, Mehreen Khan*

Department of Paediatrics, DHQ Hospital, Tank, *Department of Paediatrics, **Department of Internal Medicine, ***Department of ENT, Ayub Medical Complex, Abbottabad-Pakistan

Background: Tuberculosis is major public health problem in Pakistan and it is often unrecognized cause of morbidity and mortality in children living in endemic areas. Children with age less than 5 years, and especially those who are immune compromised, are at higher risk of developing tuberculosis following exposure. Tuberculosis in children is usually difficult to diagnose compare to adult patients due to its atypical presentation. Tuberculin skin test and Bacille Calmette–Guerin (BCG) are widely used as diagnostic tests for tuberculosis. It was a Cross sectional study carried out from May 2017 to Nov 2018 in the department of Paediatrics, Ayub Teaching Hospital Abbottabad. **Methods:** Both BCG and tuberculin skin test were performed at the same time by the same doctor. Personal data like age, gender and address, type of tuberculosis, positivity of tuberculin skin test and positivity of diagnostic BCG were recorded. The induration was read 48-72 hours after administration. **Results:** As per frequencies and percentages for positivity of tuberculin skin, 51 (67.10%) patients showed positivity for tuberculin skin while 71 (93.42%) patients showed positive results via BCG Test. **Conclusion:** In paediatric age group, diagnostic BCG test has got better diagnostic value over Tuberculin Skin Test in diagnosis of tuberculosis.

Keywords: Tuberculin Skin Test; BCG Test; Pulmonary Tuberculosis

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INTRODUCTION

Tuberculosis stands one of the major public health issues in Pakistan and stands fourth amongst high burdened countries for tuberculosis worldwide as approximately 510,000–730,000 individuals have active disease in the country at any given time.¹

Tuberculosis is one of the fatal communicable diseases globally. In 2013, about 9 million people developed tuberculosis and for 1.5 million it proved fatal worldwide.²

Tuberculosis often remains unrecognized cause of disease and death in children who are living in endemic areas. Immunocompromised children and those under age of 5 years are at increased risk to develop tuberculosis following contact.³ Accurate and prompt diagnosis of tuberculosis in children is very important to start clinical management and infection control measures.⁴ In adults tuberculosis is usually easily recognized due to its typical presentation, i.e., radiological features and positive sputum smear, whereas tuberculosis in children is more difficult to diagnose because of its atypical radiological features and the difficulty to collect sputum.⁵

Patients diagnosed with tuberculosis should be treated with multiple agents to achieve bacterial clearance which not only reduce the risk of transmission to others but also prevent development of drug resistance.⁶

Tuberculin skin test is widely used as an important diagnostic test of tuberculosis. Though it is commonly used by physicians worldwide but its interpretation is always difficult and different among different conditions.⁷ Various factors like age, immunological status, under nutrition, co-morbidities etc influence the results, so much care is needed while interpreting its results.⁷ An induration of 10mm or more is usually considered positive but in children who are BCG vaccinated an induration of 15mm or more is considered positive and this is due to tuberculosis infection and cannot be attributed to previous BCG vaccination.⁸

BCG is another reliable and sensitive diagnostic test for tuberculosis. It is especially valuable in the diagnosis of tuberculosis in developing countries where tuberculosis is still a major public health problem.⁹ BCG test is considered positive if the induration become 10mm or more in diameter.¹⁰

A study carried in Rawalpindi showed the positivity of diagnostic BCG as 99% and that of tuberculin skin test as 73%.¹¹

The aim of this study was to compare positivity of tuberculin skin test with diagnostic BCG in children suffering from tuberculosis. The purpose of this study was to provide tools for early diagnosis of tuberculosis so that immediate medical intervention can be provided to prevent the spread of

disease, and its devastating complications like disseminated tuberculosis and tuberculous meningitis.

MATERIAL AND METHODS

This cross-sectional study was conducted from May 2017 to Nov 2018 in the department of Paediatrics, Ayub Teaching Hospital Abbottabad. A total of 76 patients of tuberculosis, diagnosed on the basis of modified Kenneth Jones Criteria, aged between 1 and 15 years were included in the study through non probability consecutive sampling. Patients who were diagnosed cases of HIV, those on immunosuppressive drugs and patients with other chronic diseases including Hodgkin disease, diabetes mellitus and chronic renal failure were excluded. Approval from hospital ethical and research committee was obtained and the procedure was explained to patients and parents. An informed written consent was obtained before enrolling the patients into the study. Both BCG and tuberculin skin test were performed at the same time by the same doctor and data was recorded on a predesigned pro forma. 0.1ml of tuberculin purified protein derivative (PPD) was injected on anterior surface of right forearm intradermally and the induration was read between 48–72 hours after administration. Tuberculin skin test was considered positive if the induration was 10mm or more in diameter in 48–72 hours. Along with tuberculin skin test, BCG test was carried out by injecting 0.1ml of freeze-dried BCG vaccine over the deltoid muscle on the left shoulder intradermally, and the induration was read between 48–72 hours after administration. Diagnostic BCG was considered positive if the induration was 10mm or more in diameter with 48hrs, a pustule formation occurred within 5–8 days or healing occurred by scar formation over 10-15 days after placement of BCG.

All the data was analysed using software SPSS version 10. Mean±SD was calculated for numerical variable like age. Percentage and frequencies were calculated for categorical variables like gender, positivity of tuberculin skin test and BCG test and type of tuberculosis. Result of tuberculin skin test and BCG test was stratified by age and gender. All results were presented in the form of tables. Chi square test at 5% level of significance was used to determine the difference.

RESULTS

This study was carried out on 76 patients at the Department of Paediatrics, Ayub Teaching Hospital, Abbottabad. Forty-two (55.26%) patients were in 1–7 Years Age Group while 34 (44.76%) patients were recorded in 8–15 Years Age Group with mean and SD for age was 6 Years±4.33. Fifty (65.78%) patients

were male while 26 (34.21%) patients were females. There was no significant relation between different age groups and gender.

Pulmonary Tuberculosis was recorded in 16 (21.05%) patients, Tuberculosis Meningitis was recorded in 12 (15.78%) patients, Abdominal Tuberculosis was recorded in 17 (22.36%), Disseminated Tuberculosis was recorded in 17 (22.36%) patients and Miliary Tuberculosis was recorded in 14 (18.42%) patients.

Table-1: Frequencies and percentages for positivity of tuberculin and BCG skin test (n=76)

Positivity of tuberculin skin test	
Yes	51 (67.10%)
No	25 (32.89%)
Total	76 (100%)
Positivity of BCG test	
Yes	71 (93.42%)
No	05 (6.57%)
Total	76 (100%)

Table-2: Stratification of tuberculin skin test with respect to age and gender (n=76)

Age	Tuberculin skin test	Frequencies & percentages	p-value
1–7 Years	Yes	27 (35.52%)	0.560
	No	15 (19.73%)	
8–15 Years	Yes	24 (31.57%)	
	No	10 (13.15%)	
Gender	Tuberculin skin test	Frequencies & percentages	p-value
Male	Yes	32 (42.10%)	0.424
	No	18 (23.68%)	
Female	Yes	19 (25%)	
	No	07 (9.21%)	

Table-3: Stratification of BCG test with respect to age and gender (n=76)

Age	BCG test	Frequencies & percentages	p-value
1–7 Years	Yes	40 (52.63%)	0.477
	No	2 (2.63%)	
8–15 Years	Yes	31 (40.78%)	
	No	03 (3.94%)	
Gender	BCG test	Frequencies & percentages	p-value
Male	Yes	45 (59.21%)	0.345
	No	5 (6.57%)	
Female	Yes	25 (32.89%)	
	No	01 (1.31%)	

DISCUSSION

In this present study the average age of the patients was 6 Years±4.33 SD, which is in accordance to 8.8±5.8 years in a study at Mosco while in a study at Germany the median age was 80.5 months.^{12,13}

The positivity of tuberculin skin test in our study was 67.10% and the Positivity of BCG Test was 93.42%. Multiple studies performed at different places have shown various results regarding the

positivity of tuberculin test and BCG as screening tests. Slogotskay L *et al*¹² showed positivity of tuberculin test as 88.7%. In a study by Mueller-Hermelink M *et al*¹³ and Velasco-Arnaiz E *et al*¹⁴ recorded 100% sensitivity for tuberculin test. Anis-ur-Rehman *et al*¹⁵ reported 40% positivity by tuberculin test and 76% positivity for BCG while on the other hand BCG test was positive in 100% of patients and tuberculin test in 44.5% in a study by GocmenA *et al*¹⁶. Similar results were found by Rabia M *et al*¹¹ and others^{17,18} Mazhar *et al*¹⁹ who found 81% positive patients with BCG skin test and 50% positive cases with mantoux test.

It was noted in our study that there was no significant effect of age on tuberculosis reactivity as 42 (55.26%) patients were in 1–7 Years Age Group while 34 (44.76%) patients were recorded in 8–15 Years Age Group. Same results were found by Carmina M *et al*¹⁷ who also found insignificant effect of age on tuberculosis reactivity. But some authors have documented the increasing effect of age on tuberculosis reactivity that is this reactivity increases as age increases,^{10,15} while others¹³ recorded that younger patients are more reactive.

In this present study, there was a male dominance with 50 (65.78%) male and 26 (34.21%) female children. Male dominance was also shown by others^{13,20} whereas Slogotskay L *et al*¹² and Anis-ur-Rehman *et al*¹⁵ showed female predominance in their studies with 55.6% and 51% females respectively. This high prevalence among male population of children may be explained by the fact that they may have more chances of exposure to tuberculous patients in their surroundings due to their more freedom of movement as compared to the female patients who are mainly confined within their homes. These results are supported by previous studies.^{21,22}

The main cause of chronic tuberculosis infection is gram-positive acid-fast bacilli, whose main source of transmission from person to person is through inhalation of droplets containing infectious germs. The diagnosis of pulmonary tuberculosis has been a challenge especially in children, because of unavailability of sputum for identification of acid-fast bacilli, which is considered as gold standard for detection of tuberculosis.²³

Tuberculosis infection is most prevalent in backward communities and similar results have been found in Pakistan where different studies confirm a link to poverty and under nutrition. Other predisposing factors are lack of awareness regarding vaccination, disease and its spread and seeking timely medical help. The immunity in growing children can also be reduced by being prone to repeated infections hence putting them at higher risk to get infected with tuberculosis.²⁴

Timely diagnosis is essential in developing countries like Pakistan where health facilities are not up to the mark and early and proper diagnosis of TB remains a challenge. Childhood Tuberculosis being completely different from tuberculosis in adult age group makes the task even more difficult. Microbiologically it is also difficult to confirm in children.^{25,26} Our study confirms that BCG skin test is much more sensitive as compared to the Mantoux test in the detection of tuberculin allergy in paediatric patients suffering from tuberculosis.

Limitations of our study include difficulty in the reading test results. Boosting by BCG vaccination or repeated skin tests may have resulted in false-positive results which were not taken into account. Also, co-infection, malnutrition, relatively small group sample, loss of control group and absence of microbiological confirmation may have bias impact.

CONCLUSION

It is concluded that in paediatric age group, diagnostic BCG test has a definite edge over Tuberculin Skin Test in diagnosis of tuberculosis.

AUTHORS' CONTRIBUTION

TA: Conceptualization, data collection. ZA: Literature search, write-up. SG: Statistical analysis, proof reading. SHM: Literature search, write-up. SMA: Proof reading. MK: Write-up.

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Address for Correspondence:

Dr. Tariq Alam, Medical officer Department of Paediatrics, DHQ Hospital, Tank-Pakistan

Cell: +92 333 996 7407

Email: drtariq58@yahoo.com