

Research Article**Comparing BCG and Mantoux test in detection of TB in Children****¹Ammara Sanam, ²Abdulrehman Khalid,****³Junaid Bashir and ⁴Nazia Shuaib**¹MBBS, Mohiud Din Islamic Medical College Mirpur, Azad Kashmir²MBBS, Hunan University of Chinese Medicine, PR, China³MBBS, Hunan University of Chinese Medicine, PR, China⁴Nursing Instructor, State College of Nursing, Mirpur, Azad Kashmir.**ABSTRACT**

Objective: For the comparison of the accuracy of the diagnostic Mantoux and BCG tests in order to diagnose and detect TB in children.

Study Design: Survey of Cross-Sectional Nature.

Place and Duration: The research study was held at an OPD of Pediatrics in Children Hospital, Lahore and Jinnah Hospital, Lahore back in August, 2014. It lasted for almost a period of two years till November, 2016.

Materials and Methods: TB diagnosed patients on the grounds of a scoring > 7 according to Kenneth Criteria were downsized for the research purpose. Written consent was also secured from the guardians of the children and they were also made familiar with the process and proceeding of the research study. An intradermal dose of freeze (0.1ml) of fresh solution (BCG vaccine) was injected (right deltoid region). The results took a period of 48 hours to 72 hours. In the same way, all the selected patients were administered with (0.1 ml of 5 TU of PPD) Mantoux test, results were also noted after the same period of time as mentioned in the case of previously used vaccine. It was ensured that the standard protocols should be observed during the both tests BCG and Mantoux.

Results: Children age 7.65 ± 5.32 years was taken as mean age for the research study. A sample fifty-four female children were selected that makes the 47.79 percent of the total sample; whereas the male children were fifty-nine in number that equals to 52.21 percent of the total sample. Children were taken as sample with cough productive in nature 71.68 percent, fever 85.84 percent, weight loss symptoms 60.18 percent. Malnutrition was observed in seventy percent of the children; whereas, only thirty-four (30.09 %) children were healthy. Seventy-seven percent of the children were diagnosed positive BCG that equals to 68.14 percent. Both Mantoux and BCG test were negative in thirty-six children and positive in forty-nine children 31.86 and 43.36 percent respectively. Mantoux test was negative in twenty-eight children with positive BCG; whereas, vice versa results were found in thirty-six children. A (<0.05) p-value was noted in the increased value of positive results on the grounds of Mantoux test as 43.36 percent in comparison to BCG test with a percent of 68.14.

Conclusion: When compared to Mantoux, BCG test results are reliable for the TB infection diagnosis in children. Malnutrition was noted in almost seventy percent of the total children. 68.14 percent of the total children were positive in BCG during the diagnosis. A total of 43.36 percent of children were diagnosed positive in Mantoux and BCG tests. Whereas, the negative diagnosis was about 31.86 percent in both the tests.

Keywords: BCG Skin Test, Accuracy, Mantoux Test and Tuberculosis/TB.

INTRODUCTION

Almost one third of the world's total population is affected by an infection called Pulmonary TB. This infection is contagious in nature. In the developing countries this burden had raised to

seventy-five percent as the resident population face this infection. Pakistan is no more an exception as the rate of TB in Pakistan is actively reached 2.5 million as estimated till date. In the

age groups of Pediatrics this is high incidence rate that contributes in the spread of TB[1;2]. The underdeveloped and backward regions of the country suffer much than the developed countries. Less facilities and non-adherence are the major contributing factors. Education is awareness are mandatory in this respect. Children are more likely to be the target of TB because of nutritional habits that are not healthy and weak immunity due to poverty that makes one unable to feed properly. WHO grades Pakistan at sixth position in the list of TB affected countries as prevalence rate of TB is forty-four percent and registered cases of TB are four percent. Whereas, on the risk are 2.5 percent, active disease is transferred to five to ten percent of children, remaining eighty to ninety percent of the cases in children end in an infection called LTBI (Latent TB Infection). Death rate in the children of TB is almost eight to twenty percent [3].

An early and in time treatment and diagnosis can control the rate of infection. Clinical results, X-ray of chest, bacilli identification, granulomatous lesions and detection of histopathology are the assisting factors in the diagnosis of the disease [4]. Another common and useful way of diagnosing TB is method of screening with the help of tuberculin skin test, it enables the detection cell-mediated response in the Mycobacterium TB antigens mixture for inoculation. Few of these are common to non-TB mycobacteria and BCG [5]. There is a wide range of TB detection tests in children, such as Mantoux test for the initial careening and diagnosis of TB. If the child has effects of malnutrition than the test has limitations. Biased results are possible in the presence of a deficiency in the post measles infection and immune system. In the pediatric groups of age BCG test is also employed for the screening of TB in patients. This test is also graded the best test for the TB infection. Indian and Pakistani numerous studies have proved this test effective in the diagnosis of TB infection in children. Results are comparatively satisfactory than other methods and tests [6]. BCG reactivity is the base of mechanized skin test of BCG specially in non-immunized patients. Indurations appear

within the period of two to three weeks after the injection of intradermal. Pustule is formed from 4th to 6th week and healing process competes from 8th to 12th week. Research study held in D.G. Khan reflects that in the numerous forms of TB the best diagnostic tool was BCG as it diagnosed TB in various patents [7]. When we compare BCG test to Mantoux test BCG has fairly good percentage of positive rate than Mantoux test, that is 75% and 45% respectively. Already available literature on the subject also reveals regarding TB in children that BCG has a vivid edge over the Mantoux test [8]. Whereas, the population is never tested for the factor of efficiency. This perspective efficiency is less researched and probed. The same neglected field of efficacy of BCG over Mantoux test is planned in this research study for the selected population.

METHODOLOGY

Hospital ethical committee permitted the research study before the commencement of the research project. TB diagnosed patients on the grounds of a scoring > 7 according to Kenneth Criteria were downsized for the research purpose. Written consent was also secured from the guardians of the children and they were also made familiar with the process and proceeding of the research study. The research study was held at an OPD of Pediatrics in Children Hospital, Lahore and Jinnah Hospital, Lahore back in August, 2014. It lasted for almost a period of two years till November, 2016. Both the genders patients of TB on the basis of Kenneth Edward Criteria were included from the age of four months to five years. On the grounds of patients history, ESR and physical examination pulmonary TB was diagnosed in target patients. Furthermore, sputum samples of positive nature and X-ray of chest confirmed the detection of tuberculosis.

Few patients were not included in the research study on the basis of anti-TB therapy, malignancies, bacterial or viral meningitis, foreign body, bronchiolitis, asthma and immune deficiency. WHO standard calculator was utilized for the calculation of sample size with absolute precision level of eight percent, population

proportion anticipation seventy-five percent and confidence level of five percent. A total of 113 patients were included as sample in the research study. Every patient was treated after the permission of their guardians with an intradermal dose of freeze (0.1 ml) of fresh solution (BCG vaccine) was injected (right deltoid region). The results were awaited after a period of 48 hours to

72 hours. In the same way, all the selected patients were administrated with (0.1 ml of 5 TU of PPD) Mantoux test, results were also noted after the same period of time as mentioned in the case of previously used vaccine. It was ensured that the standard protocols should be observed during the both tests BCG and Mantoux. Results of both tests are as under:

Mantoux tests:Fifteen TU of PPD was the set criteria.

Hours	Mm	Remarks
48-72	5	Non-Significant
48-72	9	Doubtful
48-72	10	Positive

Diagnostic BCG:For the complete healing an accelerated reaction of ten to fifteen days instead of routine reaction of seven to ten weeks was the selected criteria for the BCG of positive nature [7].

Time	Mm	Remarks
48-72	10-20	Moderate (+2)
48-72	21-30	Severe (+3)
Pustule formation		10-15 Days
Healing and Scar Formation		05-08 Days

A predesigned form was used for the collection of information. It was planned that the data collected will be entered in the SPSS v.16 for further analysis and statistical data collection and also for the SD and mean calculation to calculate quantitative variables. For the comparison of tests, the Chi-Square test will be employed for BCG and Mantoux tests with a significant p-value of < 0.05.

RESULTS

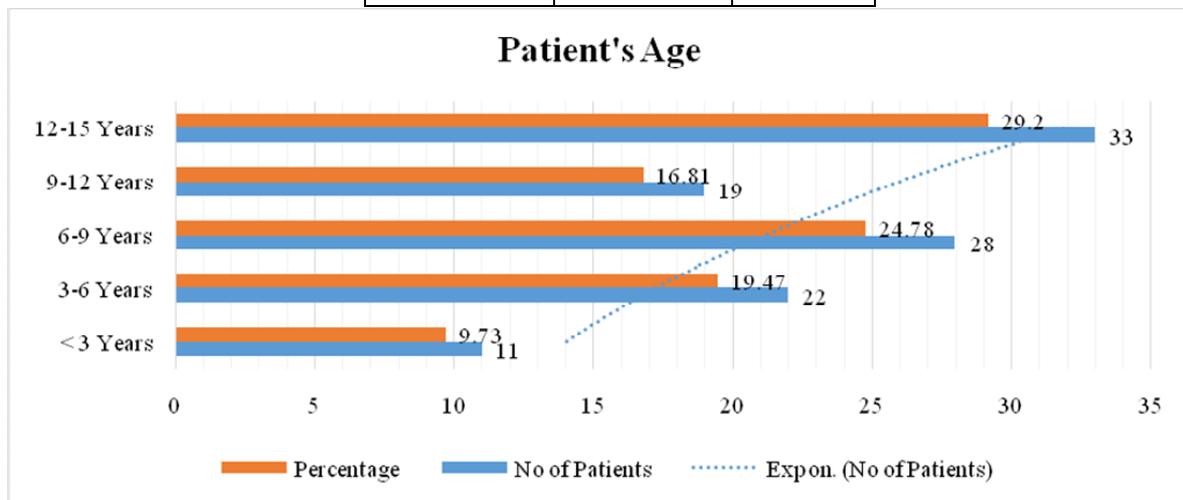
A total of 113 clinically proved for pulmonary TB were included in this study of cross-sectional nature. Children age 7.65 years \pm 5.32 years was taken as mean age for the research study, in this range of age group maximum children were on twelve to fifteen years and the next age group was from six to nine years. As sample fifty-four female children were selected that makes the 47.79 percent of the total sample; whereas the male children were fifty-nine in number that equals to 52.21 percent of the total sample. Children were taken as sample with cough productive in nature 71.68 percent, fever 85.84 percent, weight loss symptoms 60.18 percent. Malnutrition was observed in seventy percent of the children; whereas, only thirty-four (30.09 %) children were healthy. Malnutrition according to first, second and third degree as shown in figure was in 28, 25 and 26 children respectively. Whereas the same in the percentage factor was 24.78%, 22.12% and 23.01% respectively for 1st, 2nd and 3rd degree of malnutrition. Radiological results as shown in Table-I reflect consolidation with cavitation, consolidation, infiltration and cavitation as 18.58%, 23.01%, 25.66% and 25.66% respectively. Table-II reflects that Both Mantoux and BCG test were negative in thirty-six children and positive in forty-nine children 31.86 and 43.36 percent respectively. Mantoux test was negative in twenty-eight children with positive BCG; whereas, vice versa results were found in thirty-six children. Table-III reflects that (<0.05) p-value was noted in the increased value of positive results on the grounds of Mantoux test as 43.36 percent in comparison to BCG test with a percent of 68.14. When compared to Mantoux, BCG test results are reliable for the TB infection diagnosis in children. Malnutrition

was noted in almost seventy percent of the total children. 68.14 percent of the total children were positive in BCG during the diagnosis. A total of 43.36 percent of children were diagnosed positive in Mantoux and BCG tests. Whereas, the negative diagnosis was about 31.86 percent in both the tests [7].

Table 1: Demographic characteristics of study sample

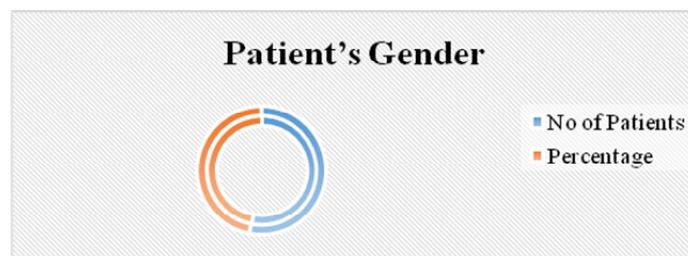
Patient’s Age

Mean ± SD	7.65 ± 5.32 years	
Age of Patients	No of Patients	Percentage
< 3 Years	11	9.73
3-6 Years	22	19.47
6-9 Years	28	24.78
9-12 Years	19	16.81
12-15 Years	33	29.2



Patient’s Gender

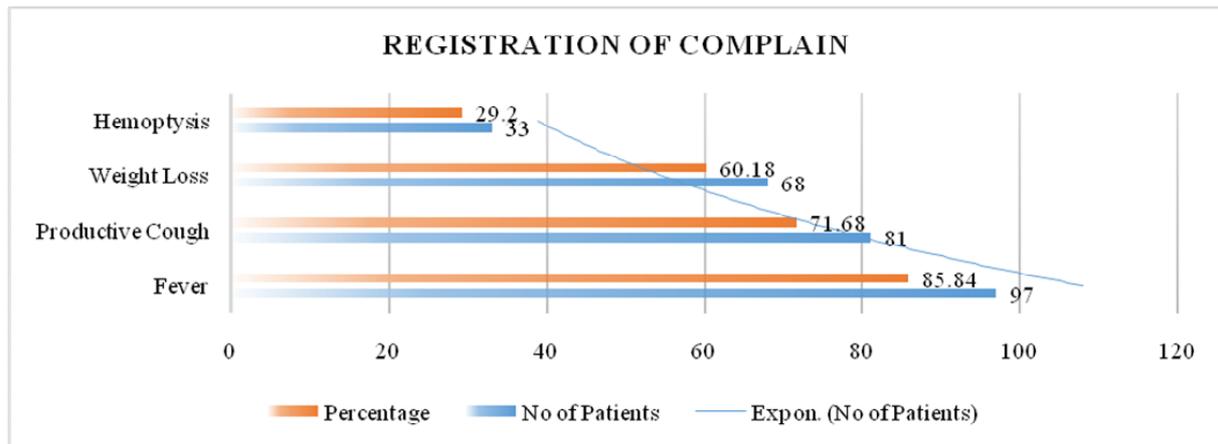
Gender of Patient	No of Patients	Percentage
Male	59	52.21
Female	54	47.79



Registration of Complain

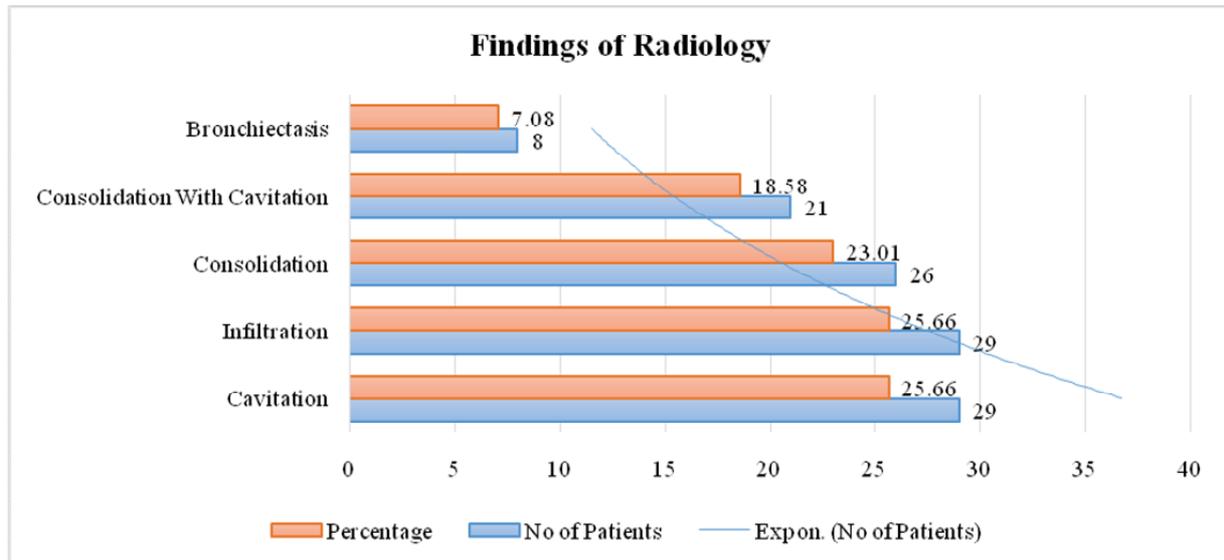
Symptoms	No of Patients	Percentage
Fever	97	85.84
Productive Cough	81	71.68
Weight Loss	68	60.18
Haemoptysis	33	29.2

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Findings of Radiology

Findings	No of Patients	Percentage
Cavitation	29	25.66
Infiltration	29	25.66
Consolidation	26	23.01
Consolidation with Cavitation	21	18.58
Bronchiectasis	8	7.08



Malnutrition

Malnutrition	No of Children	Percentage
Normal	34	30.09
First Degree	28	28
Second Degree	25	25
Third Degree	26	26

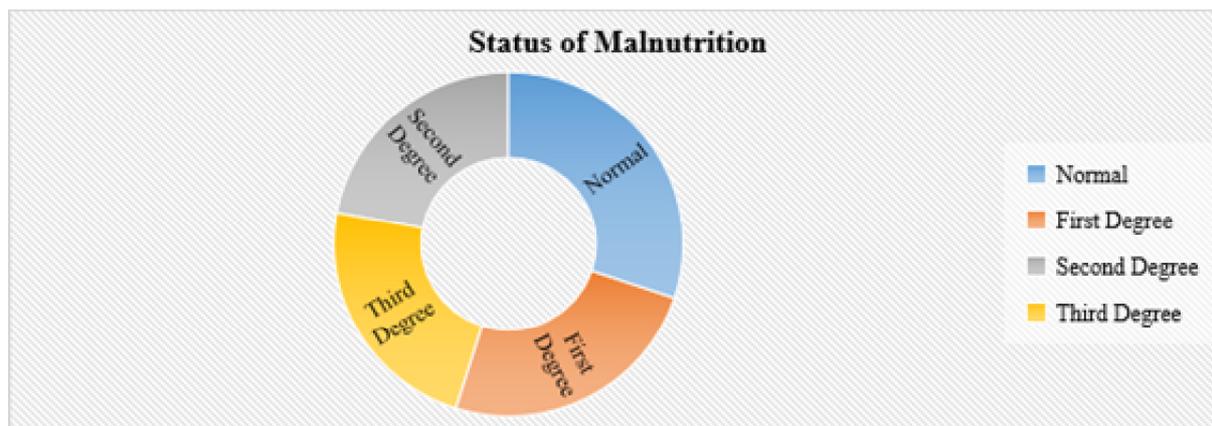
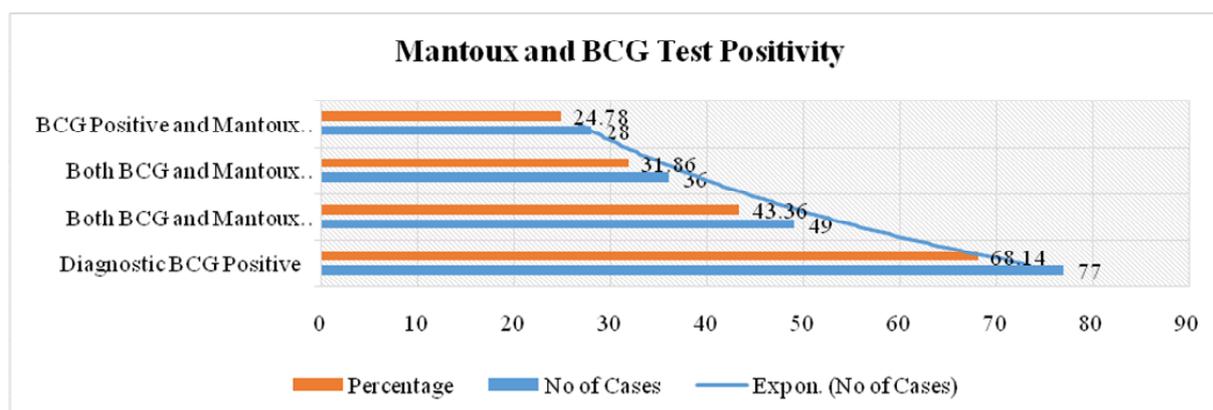


Table II: Mantoux and BCG and test Positivity

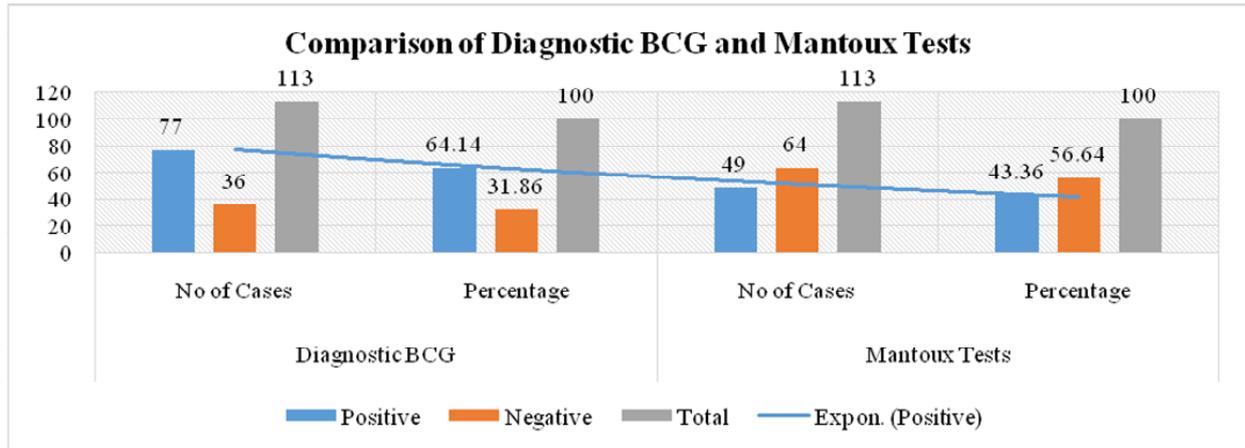
Test Results	No of Cases	Percentage
Diagnostic BCG Positive	77	68.14
Both BCG and Mantoux Positive	49	43.36
Both BCG and Mantoux Negative	36	31.86
BCG Positive and Mantoux Negative	28	24.78



The principle cause behind chronic TB is the infection which is fast bacilli acid gram positive. It transfers from one individual to another through the infection of droplets. Inhaling is the main source of this transfer. Challenging in children is pulmonary TB, as it is difficult to detect and diagnose. This diagnosis becomes difficult in the absence of acid fast bacilli. It is also ranked as supreme and golden in the diagnosis of TB and considered in the diagnostic standards [13].

Table III: Comparison of Diagnostic BCG and Mantoux tests

Test Result	Diagnostic BCG		Mantoux Tests		P-Value
	No of Cases	Percentage	No of Cases	Percentage	
Positive	77	64.14	49	43.36	0
Negative	36	31.86	64	56.64	
Total	113	100	113	100	



DISCUSSION

Almost one third of the world's total population is affected by an infection called Pulmonary TB. This infection is contagious in nature. In the developing countries this burden had raised to seventy-five percent as the resident population face this infection. Pakistan is no more an exception as the rate of TB in Pakistan is actively reached 2.5 million as estimated till date. In the age groups of Pediatrics this is high incidence rate that contributes in the spread of TB. The underdeveloped and backward regions of the country suffer much than the developed countries. Less facilities and non-adherence are the major contributing factors. Education is awareness are mandatory in this respect. Children are more likely to be the target of TB because of nutritional habits that are not healthy and weak immunity due to poverty that makes one unable to feed properly. WHO grades Pakistan at sixth position in the list of TB affected countries as prevalence rate of TB is forty-four percent and registered cases of TB are four percent. Whereas, on the risk are 2.5 percent, active disease is transferred to five to ten percent of children, remaining eighty to ninety percent of the cases in children end in an infection called LTBI (Latent TB Infection). [3] Death rate in the children of TB is almost eight to twenty percent. The rate of childhood mortality and morbidity in the underdeveloped countries is very alarming as a total 400,000 died before reaching the age of fifteen years [9].

The under-hand research paper reveals that the age significantly effects the reactivity of tuberculosis. This fact is also supported by Carmina, as results were formed on the same statistical counts. Whereas, few other researchers have stated that the effects of tuberculosis are increasing with the increase in age [10]. This study also reveals that males are in dominance when compared to female with an average of 52.21% and 47.79% respectively. Children are prone to TB if they are in the vicinity of any elder TB patients. Male have liberty to move and animate around whereas in the case of females this mobility is somehow limited. Previous studies also support the result of this research study as female are restricted to their homes in majority of the cases.

Infection of TB is prevalent in backward areas and countries like Pakistan where poverty is in abundance and people are living even below the poverty line. Non-adherence to hygienical states and unawareness are also contributing factors of TB infection. Specially the poor areas of Hazara and other same regions of the country remote and far-fetched suffer from these infections. Ignorance, malnutrition and poverty are the contributing causes of tuberculosis infection in children. Repeated exposure to Tb results in reduced immunity. Risk of Tb increases in the case of deficiency of immunes in children [11]. Pakistan falls of seventh number in the highest effected countries with infection of TB. Early diagnosis and proper follow-up is not

observed in Pakistan. Adults TB is far different from the underaged Tb patients. There are no visible signs and symptoms of TB in children and it becomes difficult to diagnose. Diagnosis of TB is also difficult in the field of Microbiology. Malnutrition was observed in seventy percent of the children; whereas, only thirty-four (30.09 %) children were healthy. Malnutrition according to first, second and third degree as shown in figure was in 28, 25 and 26 children respectively. Whereas the same in the percentage factor was 24.78%, 22.12% and 23.01% respectively for 1st, 2nd and 3rd degree of malnutrition. The outcomes are the same in the previously held research studies. It is prevalent in the sixty to hundred percent of the patients.

This research paper also confirms the sensitivity of BCG test in comparison with Mantoux test for the detection and diagnosis of TB infection, allergy of tuberculin and pulmonary TB. This research paper's observation is almost the same of the studies conducted in India and Peshawar, Pakistan [10, 13, 18, 19, 20 and 21]. Seventy-seven percent of the children were diagnosed positive BCG that equals to 68.14 percent. Both Mantoux and BCG test were negative in thirty-six children and positive in forty-nine children 31.86 and 43.36 percent respectively. Mantoux test was negative in twenty-eight children with positive BCG; whereas, vice versa results were found in thirty-six children. A (<0.05) p-value was noted in the increased value of positive results on the grounds of Mantoux test as 43.36 percent in comparison to BCG test with a percent of 68.14. When compared to Mantoux, BCG test results are reliable for the TB infection diagnosis in children. Malnutrition was noted in almost seventy percent of the total children. 68.14 percent of the total children were positive in BCG during the diagnosis. A total of 43.36 percent of children were diagnosed positive in Mantoux and BCG tests. Whereas, the negative diagnosis was about 31.86 percent in both the tests.

It is observed and presumed from the previous studies that already vaccinated patients of BCG can escape the diagnosis of TB depending on the

duration and time spent after vaccination. BCG vaccines do not affect the reactivity of the TB infection. No visible differences were noticed in the vaccinated patients of TB in the results of skin test of BCG in comparison with never vaccinated children. This can be deduced from the in-hand research paper that importance is given to the positive diagnosis of BCG test over Mantoux test. As the contrast of BCG is very high in comparison with Mantoux test. Previous researches on the same topic of efficacy also reveals and support the current results and outcomes [12].

CONCLUSION

Results reveal the superiority of BCG over Mantoux tests. As in the sample of 113 patients, children age 7.65 years \pm 5.32 years was taken as mean age for the research study. As sample fifty-four female children were selected that makes the 47.79 percent of the total sample; whereas the male children were fifty-nine in number that equals to 52.21 percent of the total sample. Children were taken as sample with cough productive in nature 71.68 percent, fever 85.84 percent, weight loss symptoms 60.18 percent. Malnutrition was observed in seventy percent of the children; whereas, only thirty-four (30.09 %) children were healthy. Seventy-seven percent of the children were diagnosed positive BCG that equals to 68.14 percent. Both Mantoux and BCG test were negative in thirty-six children and positive in forty-nine children 31.86 and 43.36 percent respectively. Mantoux test was negative in twenty-eight children with positive BCG; whereas, vice versa results were found in thirty-six children. A (<0.05) p-value was noted in the increased value of positive results on the grounds of Mantoux test as 43.36 percent in comparison to BCG test with a percent of 68.14. When compared to Mantoux, BCG test results are reliable for the TB infection diagnosis in children. Malnutrition was noted in almost seventy percent of the total children. 68.14 percent of the total children were positive in BCG during the diagnosis. A total of 43.36 percent of children were diagnosed positive in Mantoux and BCG tests. Whereas, the negative

diagnosis was about 31.86 percent in both the tests. The positive ratio of BCG is noticeably high in comparison to Mantoux test in the patients of pulmonary tuberculosis from pediatric age groups of the patients.

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