

## Retrospective analysis of positive Mantoux test in cases of suspected *Mycobacterium Tuberculosis* infections seen at a tertiary hospital in Northeastern, Nigeria

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### Abstract

Mantoux test continued to be used for detection of latent and active tuberculosis infections, despite its low sensitivity and specificity rate. This retrospective study analysed positive mantoux test results over 5 years period and compared the finding with demographic variables of the patients. Mantoux test was carried out on patients presented at the hospital with clinical condition suspected of tuberculosis infections. Of 3215 patients screened, 1532 (47.8%) demonstrated positive result, with patient mean age of  $25.5 \pm 17.38$  years and 48.2% cases occurred within the age range of 21-40 years. Gender pattern of 64.0% male and 36.0% female with M:F of 1.8:1 was observed, and 24.8% were inpatients and while 75.2% outpatients. Of the 16 clinical diagnosis documented, positive results were recorded in 12 cases and statistically significance difference was observed in patients with Pott's diseases, low back pain, and routine medical examination ( $p < 0.001$ ). The mean induration diameter was  $14.75 \pm 5.6$  mm, and 50.8% observed within 10-15 mm. In conclusion, the 47.2% positivity rate recorded in this study, affirmed the endemicity of tuberculosis in sub-saharan African countries and diversity in the clinical presentation. Public health education and improvement in health seeking behavior for early detection and treatment remain one of the infection control approach.

Keywords; Positive Mantoux test, suspected tuberculosis infection, Northeastern Nigeria

{Citation: Okon KO, Ajayi BB, Balogun ST, Adelowo K, Askira U.M, Jibrin YB. Retrospective analysis of positive Mantoux test in cases of suspected *Mycobacterium Tuberculosis* infections seen at a tertiary hospital in Northeastern, Nigeria. American Journal of Research Communication, 2014, 2(5): 96-102} [www.usa-journals.com](http://www.usa-journals.com), ISSN: 2325-4076.

## Background

Tuberculosis, remain one of the major public health problem globally, with high burden in sub-saharan African countries, due to the high morbidity and mortality recorded. The attendant effect is furthered worsen with emergence of TB and HIV/AIDS co-infections, compounding treatment, management and infection control approach. An estimated 8.3 million new infections and 1.8 million deaths each year (WHO 2010). Majority of people infected with *Mycobacterium tuberculosis* remain asymptomatic (latent infection, and the infected patients remain the source of active infection. Some of the major factor confronting the effective and efficient treatment of active TB in developing countries are late diagnosis and treatment of patients with active infection, and poor health seeking behavior of infected individuals. Tuberculin skintest (Mantoux test) was introduced over a century ago, for detection of latent and active *Mycobacterium tuberculosis* infection, and had formed the key component of infection control approach. However, different factors like host, environment and techniques of detection are known to influence the result outcome (Gustafon et al 2007).

Over the years, newer blood-based assay with higher sensitivity and specificity had been introduced in the detection of tuberculosis, but adoption for routine laboratory purposes in resource-limited laboratories in Africa with high endemic TB infection is difficult. This is due to high cost of reagent and equipments. The continued usage of Mantoux test is based on its cheap, simple and easy to perform. This 5-year retrospective study assessed the Mantoux test positivity among patient seen in a tertiary hospital in northeastern Nigeria.

## Methodology

This retrospective study was carried out in the department of Immunology and Infectious disease , University of Maiduguri Teaching Hospital, Maiduguri between January 2005 to December,2009. The study extracted mantoux test requests and analysed results over the study period. Information extracted included,, age, sex, suspected tuberculosis cases, Mantoux test result, and induration diameter. Patients included in the study were those seen at the general outpatient and on admission presenting with suspected *Mycobacterium tuberculosis* infection. Purified Protein Derivative-Siebert(PPD-S) stabilized in Tween 80 were used for the injection on the patient forearm.The skin induration diameter read after 72 hours. Induration diameter of >5mm was considered positive. A total of 16 suspected cases of tuberculosis were identified, and some cases without detailed clinical information.

Data analysis was carried out using SPSS version 16.0, with the values expressed in means and percentages. Percentage of positive result in a particular disease conditions is calculated by dividing the number positive cases by total number of cases screened multiply by 100. Comparson of variables was determined by chi-square test or Fisher test where appropriate, at significant level of  $p < 0.05$ .

## Results

Of 3218 suspected tuberculosis patients screened by Mantoux test over the study period, 1532 (47.6%) demonstrated positive mantoux test results, 64.0%(n=980)males and 562(36.0)females, giving a M:F ratio of 1.8:1.The mean age of the patient was 25.5+17.38 years, 21-40years (48.2%, n=735), < 20years (34.8%,n=536), 41-60years (13.0%, n=199) and > 60 years (4.0%, n=61) (p<0.0001). 380(24.8%) were on admission and 1152(75.2%) seen on outpatient basis. The breakdown of the induration diameter, 5-9mm(15.9%, n=244), 10-15mm (50.8%,n=778) and >15mm (33.3%,n=510). Positive mantoux test versus patient age-group and suspected *Mycobacterium tuberculosis* diseases conditions was recorded(table 1), Of the 16 suspected cases of tuberculosis screened, positive mantoux test results were recorded in 12 clinical conditions. Statistical Significant difference was observed in pott's diseases(61.0%,p<0.0001), low back pain (78%, p<0.0001) and routine examination(72.5%, p<001). 49.2% positive result recorded in suspected PTB cases,72.8%, 75%, 68.1% in suspected cases cervical lymphadenitis, fever/rashes, and lymphnode enlargement respectively. The induration diameter as against the age-group of the patient and suspected cases as shown in table 2, showed that high number of positive result occurred more within 10-15mm compared to 5-9mm and >15mm(p<0.0001).

**Table 1: Factors associated with Positive Mantoux test**

Age-group	positive Mantoux test(%)	p-value
< 20 years	536(34.8)	0.00001
21-40	735(48.0)	
41-60	199(13.0)	
>60	61(4.0)	
<b>Source of the patients</b>		
Inpatients	380(24.8)	0.0001
Outpatients	1152(75.2)	
<b>Associated Clinical details</b>		
PTB	538(49.2)	0.0001
Pott's disease	173(61.0)	
Low Back pain	117(78.0)	
Orthoarthritis	46(76.7)	
RVI	81(50.6)	
Abdomen swelling	-	
Cervical Lymphadenitis	47(75.8)	
Fever/rashes	3(75)	
Weight Loss	171(40.5)	
Bronchopneumonia	75(36.8)	
Lymphnode enlargement	49(68.1)	
Malnutrition	-	
Cancer of Prostate	-	0.99
Intestinal obstruction	-	
NCD	203(45.5)	
Routine examination	129(72.5)	

NCD- no clinical details provided.

**Table 2: Mantoux test Induration diameter Versus age group and associated clinical details of the patients**

Age group	5-9	10-15	>15	p-value
<20 years	104	196	80	
21-40	100	434	330	
41-60	34	118	86	<b>0.0001</b>
>60	8	30	16	
	244(15.9)	778(50.8)	510(33.3)	
<b>Associated Clinical details</b>				
PTB	92	230	196	
Pott's disease	26	80	38	
Low Back pain	10	56	30	
Orthoarthritis	0	18	8	
RVI	16	26	18	
Abdomen swelling	0	0	0	<b>0.00001</b>
Cervical Lymphadenitis	6	8	12	
Fever/rashes	2	0	0	
Weight Loss	22	78	50	
Bronchopneumonia	14	32	8	
Lymphnode enlargement	2	16	10	
Malnutrition	0	0	0	
Cancer of Prostate	0	0	0	
Intestinal obstruction	0	0	0	
Others	30	98	54	
Routine examination	14	58	30	
	<b>244(15.9)</b>	<b>778(50.8)</b>	<b>510(33.3)</b>	

**No clinical details provided.**

### Discussion

The simplicity and cost effectiveness of Mantoux test had made it adopted in low-resource routine laboratories for detection of mycobacterium tuberculosis infection. Even though the use of acid fast bacilli staining (ZN) and cultural methods, are limited by public health implication of exposure to the bacilli and long period of incubation.

In this study, the prevalence of positive mantoux tests was 47.8%, this result seems not surprising as there is likelihood of false-positive results. Factors such as , host (immunocompromised status, bacillus Calmette Guerin (BCG) vaccination, age of patient), environmental (overcrowding, malnutrition, exposure/contact with untreated active tuberculosis infected patient) and technical (tuberculin dosage and induration diameter reading) are known to influence the result (Chaparas et al 1970, Vandiviere et al 1980, Cauthen et al 1986, Gustafon et al 2007). However, the worldwide frequency of positive mantoux test is 30% but that level could be as high as 80% in high risk group due to contact/ exposure to untreated active tuberculosis patient (Dye et al 1999). Different prevalence levels have been reported,

41% in India, 40% in Pakistani, 38% in South Africa and 64% in Zimbabwe (Dye et al 1999, Pai et al 2005). The demographic pattern of clinical prognosis of tuberculosis showed a wide diversity, apart from suspected cases of pulmonary tuberculosis, 12 different clinical presentations were documented associated with extrapulmonary tuberculosis (Cauthen et al 1986).

Our concept of the study was to evaluate if there is a correlation between the demographic variables and positive Mantoux test, which might provide baseline information to clinicians and laboratory personnel on this simple test. Demographic variables of patients with positive Mantoux test showed a mean age of 25.5 ± 7.89 years, and a significant proportion within the age group 21-40 years (48.2%). Documented studies had reported varied mean age and age group of tuberculosis patients with geographical locations, clinical condition and studied population (Borgdoff et al 2001, Kaur et al 2012). The association between gender difference with tuberculosis infection rate had featured in most documented studies, in which the WHO global report on TB infection affirmed male predominance, as observed in this study (64.0% male vs 36.0% female) (WHO, 2000). Also, the male to female ratios with different regions, with 1.35:1 in Africa, 1.49:1 in America, 2.03:1 in South Asia, and 2.16:1 in Europe (Roya et al, 2007). Higher differences such as 3.33:1, 3.5:1, 4.0:1 and 5.5:1 have been reported elsewhere, compared to 1.7:1 documented in this study (Baboolal et al 2001, Gopi et al 2003, Kaur et al 2012, Pai et al 2012, Sanneh et al 2012).

The major problem of tuberculosis infection in sub-Saharan African countries is the high latent infection progressing to active state due to poor health seeking behaviour of the high risk populace. The presentation of chronic state, particularly in cases of pulmonary tuberculosis, increases the morbidity and mortality recorded in our hospitals. This observation might explain the source of patients studied, as 24.8% were those on admission compared to those seen on outpatient basis (75.2%). Clinical manifestation of extrapulmonary tuberculosis is diverse, from pyrexia of unknown origin to anorexia, weight loss, malaise and fatigue, which pose a serious challenge in clinical diagnosis.

Several factors are known to influence the outcome of Mantoux test result and its interpretation. As the test does not measure the degree of immunity to tuberculosis infection, the induration reaction is due to a cellular mediated response of sensitized lymphocytes. Therefore, there is no correlation between the size of induration diameter and likelihood of current active tuberculosis infection. Though induration diameter varies with studied population, either based on contact/or exposure to untreated active tuberculosis patient (Pilszek et al 2008). But, the reaction size could be used in identification of high risk individuals as provided in the American Thoracic Society guidelines on interpretation of positive Mantoux test based on the induration diameter (ATS, 2000).

## Conclusion

Although Mantoux test positivity is limited by different factors, the level of 47.8% positivity still affirmed the endemicity of tuberculosis and diverse clinical presentation of Mycobacterium tuberculosis infection. However, utilization of this laboratory test should be collaborated with clinical indices and other laboratory tests as a guide against false-positive results.

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