

EMERGENCE OF TUBERCULOSIS INFECTION: A SERIOUS THREAT TO THE NATION'S HEALTH

RAHMANI M.T.H., SAEED M., HUSSAIN S., RASHEED F., AHMAD R. AND BHATTI Z.A.
Department of Pathology, Allama Iqbal Medical College and Jinnah Hospital, Lahore

ABSTRACT

Background and Objective: In spite of major steps taken to switch Tuberculosis (TB), the frequency has climbed drastically. The lack of intervention health sector policies, there will be possibility of worse conditions in the near future. The present study was designed to evaluate the frequency of *Mycobacterium tuberculosis* (MTB) infection in pulmonary and extra pulmonary tuberculosis (EPTB) suspects attending Jinnah Hospital, Lahore, in year 2015 for the diagnosis and screening.

Methods: This cross sectional study was conducted at pathology department of Allama Iqbal Medical College and Jinnah Hospital Lahore (AIMC & JHL) from January 2015 to December 2015. This study co-mprised of a total of 993 TB suspects (pulmonary and extra pulmonary) between the ages of 15 to 60 yea-rs. New TB suspects were included and previously diagnosed TB cases were excluded from our study. All PTB and EPTB specimens were processed on real time PCR based GeneXpert MTB/RIF assay for the detection of MTB.

Results: Out of total 993 cases, 29% (289/993) cases showed presence of MTB in their samples. The rate of MTB infection in females was high 30.93% (176/569) as compared to male patients 26.65% (113/424). MTB infection at different ages showed high frequency 31.31% (119/380) among age group of 31 – 40 years, and least frequency 20.00% (16/80) was found among age group of 20 – 30 years. Out of 800 (80.56%) PTB cases, 254 (31.39%) were positive for MTB and out of 193 (19.43%) EPTB suspects 35 (18.13%) were diagnosed as MTB positive by GeneXpert assay.

Conclusion: In high burden TB region of the world, there is need to strengthen rapid TB diagnostic facilities. Utility of GeneXpert assay has provided an excellent opportunity for rapid diagnosis of TB.

Keywords: GeneXpert, MTB, Real Time PCR.

INTRODUCTION

In spite of major steps taken to reduce Tuberculosis (TB) burden, the frequency has climbed drastically and health care system is struggling to manage TB. Due to lack of intervention health policies, there would be possibility of worsening conditions in the near future.¹

Among third world countries TB is one of the major causes of morbidity and mortality. With the passage of time, burden of this infection is continuously growing because of less sensitive diagnostic techniques and inadequate treatment. According to a global estimate in 2015, almost 9.6 million new TB patients comprised of Men, women, and children 5.4 million, 3.2 million, and 1.0 million respectively were identified.² Tuberculosis kill 1.5 million patients, of which men were 890,000 and the death rate among women and children's were 480 000 and 140 000 respectively.³ An unacceptable rise in the frequency of TB deaths has been observed in last decades.

The year 2015 is a watershed in the fight against TB. Its hope that death incident rate due to TB would

be reduced as compared to previous years. During the time period of 2000 to 2014, an estimated 43 million peoples have been saved by introduction of effective and more rapid diagnostic tools.⁴ Rapid and timely diagnosis and appropriate drug therapies can help in the management and cure million of lives. Tuberculosis control is a growing challenge for clinicians globally. Due to worsening health strategies, lack of prevention systems and awareness about TB in developing countries like Pakistan, TB was professed as global emergency by world health organization (WHO).

Worldwide emergence has been reported in both developed and developing countries and poses a major threat to the TB control strategies. TB continues to be one of the major health problems faced by millions of people each year and declared as a leading cause of mortality worldwide.

Tuberculosis is a communicable disease therefore; environmental conditions influence the susceptibility to infection caused by *M. tuberculosis* (MTB).⁵ Active pulmonary tuberculosis (PTB) cases are the key agent

for the burden of disease. This infectious disease is spread via aerosols, inhalation of droplets nuclei of 1.5 micron in size, which are spread by coughing and sneezing by patient positive for acid fast bacilli (AFB).⁶ These are at least 3000 droplets generated in a single cough, which dry quickly but stay suspended in air for many hours.⁷ The disease mostly attacks the lungs, although in certain cases other body parts may be infected.⁸

The present study was designed to evaluate the frequency of Mycobacterium tuberculosis (MTB) infection in pulmonary and extra pulmonary tuberculosis (EPTB) suspects attending Jinnah hospital Lahore, in the year 2015 for the diagnosis. The aim of our study was to evaluate the frequency of TB infected cases and the gender and age wise prevalence and distribution of TB. In current study, real time PCR based GeneXpert technology was used as a diagnostic tool for the diagnosis of TB.

METHODS

This cross sectional study was conducted at pathology department, Allama Iqbal Medical College and Jinnah Hospital, Lahore (AIMC & JHL) from January 2015 to December 2015.

This study comprised of a total of 993 TB suspects (pulmonary and extra pulmonary). The suspected patients were in the age group from 15 to 60 years. New TB suspects were included and previously diagnosed TB cases were excluded from our study. A single sputum specimen was collected from pulmonary Tuberculosis (PTB) suspect. While in case EPTB, infected samples were collected according to the site of infection. The EPTB samples include pus, pleural fluid, ascitic fluid, pericardial fluid and CSF. All PTB and EPTB specimens were processed for Real time PCR based GeneXpert MTB/RIF assay for the detection of *Mycobacterium Tuberculosis* (MTB).

The GeneXpert assay was done according to manufacturer’s standard protocols. Briefly, specimens were directly mixed with sample buffer in 2:1 ratio in closed mouth container, and incubated at room temperature

Table 1: Distribution of Tuberculosis infection in study population.

	Study Population (n = 993)			
Gender	TB suspects	Percentages	Infected	Percentage
Male	424	42.69%	113	26.65%
Female	569	57.30%	176	30.93%
<i>Age Groups</i>				
20 – 30 years	80	8.05%	16	20.00%
31 – 40 years	380	38.26%	119	31.31%
41 – 50 years	363	36.55%	111	30.57%
51 – 60 years	170	17.11%	43	25.29%
Total	993	100%	289	100%

Mean age = 37.5 SD = 7.54 years

for 15 – minutes.⁹ After incubation 2 ml inactivated sample mixture was transferred to the GeneXpert assay test cartridge, and cartridge was loaded into the GeneXpert instrument for analysis. The results were displayed on computer monitor within 2 hours.⁹

RESULTS

Total 993 TB suspects were screened out for the detection of Mycobacterium tuberculosis (MTB) infection. Out of total 993 TB suspects 42.69% (424/993) were males and 57.30% (569/993) were females respectively. The rate of MTB infection in females was high as compared to male patients (**Table 1**). MTB infection at different ages in the study population was also noted which showed high frequency among age group of 31 – 40 years, followed by 41 – 50 years, 51 – 60 years, and least prevalence was found in 20-30 years age group (**Table 1**).

In our study, there was high frequency of pulmonary tuberculosis suspects enrolled for the diagnosis of MTB while only 19.4% cases were EPTB. Out of 800 (80.56%) PTB cases, 254 (31.39%) were infected with MTB and out of 193 (19.43%) EPTB suspects 35 (18.13%) were diagnosed as MTB positive by GeneXpert assay (**Table 2**).

Table 2: Distribution of MTB infection among pulmonary and extra pulmonary Tuberculosis suspects.

	MTB Infected	Percentage	Negative	Percentage	Total
Pulmonary	254	31.39%	546	68.25%	800 (80.56%)
Extra pulmonary	35	18.13%	158	81.86%	193 (19.43%)
Total	289	29.10%	704	70.89%	993 (100%)

According to our study, Overall frequency showed that out of total 993 cases, 29% (289/993) cases showed presence of MTB in their sample while MTB not detected cases were 71% (704/993) respectively (**Figure 1**).

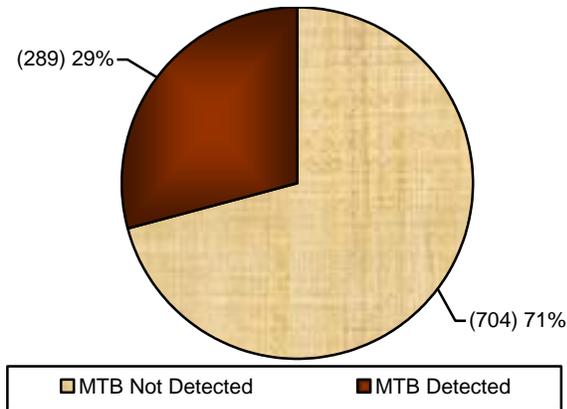


Figure 1: Overall Summary study population.

DISCUSSION

In Pakistan the prevalence of tuberculosis is growing dramatically day by day. The target of tuberculosis controls demands for coping potential capacity within the affected societies; but this capability needs to be harnessed.

Tuberculosis is a contagious and second leading cause of death from single infectious agent after HIV around the world.¹⁰ This disease is transmitted by sneezing, speak, spiting and coughing by active pulmonary TB infected person (**Figure 2**).¹¹ They produce infectious *aerosol* droplets of 0.5 to 5.0 μm in diameter, each one of these droplets can transmit the disease.⁷ Since the infectious dose of tuberculosis is very low (the inhalation of fewer than 10 bacteria may cause an infection),¹¹ an estimated 22% people that have prolonged, frequent, or close contact with people with TB infection have possibility of developing TB.¹⁰

According to WHO a single MTB infected individual can be responsible for infecting 10 – 15 normal

healthy people per year,¹² therefore, to overcome this burden rapid diagnosis and proper management is basic need of the day in our health setups. It is necessary to screen out every TB suspected case at early stage, this would in return will help in the management, prevention and controls of Tuberculosis in Pakistan; where risk factors like crowded living conditions, malnutrition, HIV infection, unavailability of diagnostic tests at hospitals and lack of TB awareness are in favor of spread of tuberculosis.¹³⁻¹⁵

According to the present study overall frequency of MTB infection in the patients attending Jinnah Hospital, Lahore was 29% which alarming situation to TB control programs. There were 31% pulmonary cases were enrolled. But in the group of EPTB suspected cases, MTB infection was found to be 18% (**Table 1**). When we studied the age factor for Tuberculosis a high rate of tuberculosis infection was seen in age group of 31 – 40 years (31.3%) followed by 41 – 50 years (30.1%), and minimal rate is observed in 20 – 30 years (20.8%) age group respectively (**Table 1**). According to our results, higher trend of TB infection was observed in older age group as compared to younger. The more exposure and low immunity in elderly age might be reason behind this high rate of TB prevalence among old people.¹ These results were similar to results of previous studies conducted on the prevalence of TB.¹⁷

Data of our study revealed that females are more prone to TB infection as compared to males. In our study out of 993 total cases, 569 TB suspects were females, and MTB was detected in 160 females. Out of total 289 MTB positive cases, 129 were males (Table 1). These results were in agreement with other studies, which also reported high rate of TB among females as compared to males.¹⁸

In our study, the overall prevalence of Tuberculosis in people visiting tertiary care hospital of Lahore was 29.10% (704/993), which includes 31.1% PTB and 18.13% EPTB cases respectively. Our findings were comparable to results of a study which reported the prevalence 37%.¹⁹ But various studies reported different data regarding MTB prevalence in different regions of world and Pakistan. In 2015, a similar study was conducted by Iram et al, she reported the prevalence of MTB 45.3% (111/245.3), this rate is higher than results of our study.²⁰ Aftab et al, conducted a study to evaluate the prevalence of TB in community of Lahore from 2001 – 2006, he reported 11.65% rate of MTB positivity in Lahore.¹⁸

It is **concluded** that the rapid diagnosis of tuberculosis can be made possible by using GeneXpert assay, which has tremendous impact in the diagnosis and screening of TB suspects. The finding of our study shows that Xpert MTB/RIF assay is an accurate, sensitive, and specific test for the rapid detection of pulmonary and Extra pulmonary cases within 2 hours.

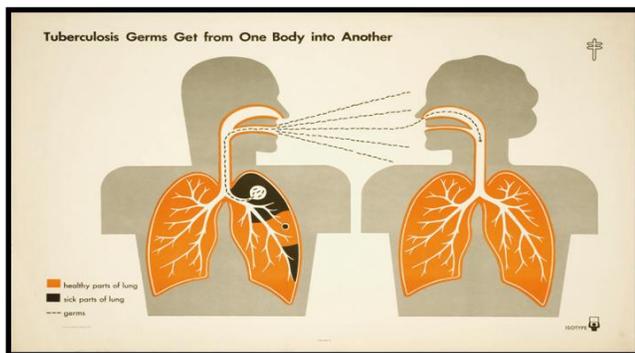


Fig. 2: Transmission of Tuberculosis infection.

ACKNOWLEDGMENTS

We are thankful to staff members of microbiology lab, pathology department, Allama Iqbal Medical College Lahore Pakistan, who helped us in data collection and sample processing, Especially Dr, Shagufta Irum, Shair Muhammad and Muhammad Kashif.

Author's Contribution

M.S.: Principal investigator, Study design, performing lab work, manuscript writing. **M.T.H.R.:** Supervised the lab work, and editing of manuscript. **S.H.:** Assisted in lab work, data collection, review manuscript. **F.R.:** Compilation of results. **R.A.:** Assisted in data collection. **Z.A.B.:** Statistical analysis.

Grant Support and Financial Disclosures

All Authors declare no conflict of interest and funding from any company.

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