

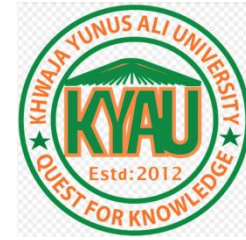
Khwaja Yunus Ali University Journal

Publisher homepage: www.kyau.edu.bd

OPEN ACCESS

ISSN: 2791-3759 (Online), 2521-3121 (Print)

Journal homepage: www.journal.kyau.edu.bd



Research Article

Prevalence and Patterns of Tuberculosis Infection by Immunochromatographic Technique in a Tertiary Care Hospital in Sirajganj

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Abstract:

Tuberculosis (TB) is one of the threatening diseases worldwide and caused by Mycobacterium tuberculosis. The incidence rate of TB is higher in Bangladesh especially in rural areas due to lower illiteracy rate, lack of awareness, poverty, not maintaining social distance, and close attachment with unhealthy individuals, unsanitary and unhygienic lifestyle. There are several approaches to diagnose TB; each with its own benefits and drawbacks but the simplest, cheapest and most reliable method is immunochromatographic

technique. In this study, samples were collected from the rural village of Sirajganj district and the hospital located in the village named Khwaja Yunus Ali medical college and hospital. In this investigation, young people (21-30 years) were more susceptible to TB, while old males (61-70 years) and young females (21-30 years) that were in grave danger. The higher amount of IgG (84.21%) and lower IgM (1.98%) antibodies in positive patient blood and rests were IgG + IgM positive were also evaluated. The goal of this study was to monitor the rate of tuberculosis infection in rural regions.

Keywords: Infection, Tuberculosis, Immunochromatography method, Prevalence, Diagnosis, Tertiary care hospital

1. Introduction:

Tuberculosis is the oldest and deadliest infectious human infection, threatening low- and middle-income countries (WHO report, 2013). According to historical data, this disease originated from Egypt's necropolis,

Europe's Neolithic burial sites, and Mummies from South America's Andes Mountains (Zink *et al.*, 2001). The etiologic agent of tuberculosis is *Mycobacterium tuberculosis*. According to World Health Organization (WHO), TB is the most lethal pathogen in the world (WHO report, 2020). In

developing countries, approximately two million deaths are reported per year by tuberculosis (Soo *et al.*, 2006). As per the estimation report of WHO, in Bangladesh, 220 per every 100,000 people are infected with TB and the mortality rate is 24% in 100,000 people (WHO report, 2020). Rural and slum TB patient's situation is worse. A research in three Myanmar communities showed the highest number of TB cases (Lwin *et al.*, 2020). A village in Ethiopia has been named as TB village (Tayler-Smith *et al.*, 2011).

Educational challenges, poor nutrition, immune system weakness, poverty, increased HIV prevalence, limited access to public services, social and civil conflict are the factors lying the increasing rate of infection of TB in rural areas (Lwin *et al.*, 2020). TB is radiographically and clinically categorized into primary and secondary TB. Primary (atypical) infection occurs in lower lobe, in early age to whom are never exposed to TB and secondary (typical) infection takes place in upper lobe and confers to the reactivation of TB into more severe form (Milburn, 2001). Even after a long history, various attempts and understanding still this infectious disease possesses a serious risk and cause of death (Lwin *et al.*, 2020).

Diagnosis of TB is mainly comprised of Direct and Immunological diagnosis (Delogu, Sali and Fadda, 2013). Direct diagnosis is made by microscopically examining sputum smears, isolating them in culture, or using molecular approaches like PCR and TMA, which are sensitive, but costly and difficult to operate (Delogu, Sali and Fadda, 2013). Recently developed molecular techniques for TB detection are highly sensitive and automated, although not appropriate for low amount of specimens (Evans 2011, Centers for Disease Control and Prevention, 2009, Lawn *et al.*, 2011, Delogu, Sali and Fadda, 2013). The most common methods of diagnosis are AFB staining and sputum AFB culture (Feng *et al.*, 2014).

In 50-60% of cases, microscopic examinations show negative results, and culture methods require a long time to cultivate bacteria (Teixeira, Abramo and Munk, 2007). The most frequent tuberculin skin test

requires standardization. Rapid diagnostic tests are essential for early TB detection and prevention. Immunochromatography technique (ICT) has been found as sensitive, comparatively cheaper and easier diagnosis technique for TB detection that detects the presence of anti IgG in human blood (Feng *et al.*, 2014). An ICT diagnostic method was used to assess the prevalence of tuberculosis at Khwaja Yunus Ali University in Enayetpur, Sirajganj, Bangladesh.

2. Materials and Methods

2.1 Sample collection and processing technique: 400 blood samples were collected from the patients of different areas of Sirajganj district and the Khwaja Yunus Ali medical college and hospital (a tertiary care hospital). The specimen was either immediately tested or refrigerated (up to two days). Refrigerated sample was brought about in room temperature.

2.2 Diagnosis of tuberculosis positive patient by Immunochromatography method: ICT method is an immunological IgG or IgM test method that detects the presence of five mycobacterial antigens through antibody-antigen interaction (Bartoloni *et al.*, 2003 and Ben-Selma *et al.*, 2011). Higher quantity of IgG indicates strong IgG response with low amount of IgM and IgA (Feng *et al.*, 2014). In this method Aria® TB IgG/IgM Combo rapid test kit was used which is manufactured by CTK Biotech. Inc, USA.

According to manufacturer instruction, the test kit was placed on clean, flat surface and marked with specimen ID number. The plastic dropper was filled with specimen and the dropper was held vertically. One drop of sample (about 40-50µL) was dispensed into the sample well to ensure bubble free condition. Then one drop of sample diluent (about 35-50µL) was added to the sample well with bottle positioned vertically. After 15 minutes, results were read.

2.3 Data Analysis:

Statistical Data analysis was performed using STATA/SE 12.0. The results were presented in the forms of percentages, bar diagrams.

3. Results:

400 specimens were collected. Among them 152 patients were found TB positive by ICT method.

3.1 Age distribution of MTB positive patients

This study revealed that young people with the age from 21-40 was in great risk of being infected with TB. Whereas, moderate number of patients had been observed in the age group of 41-70. However,

minimum incidence was observed in the age group of 11-20 and 71-90.

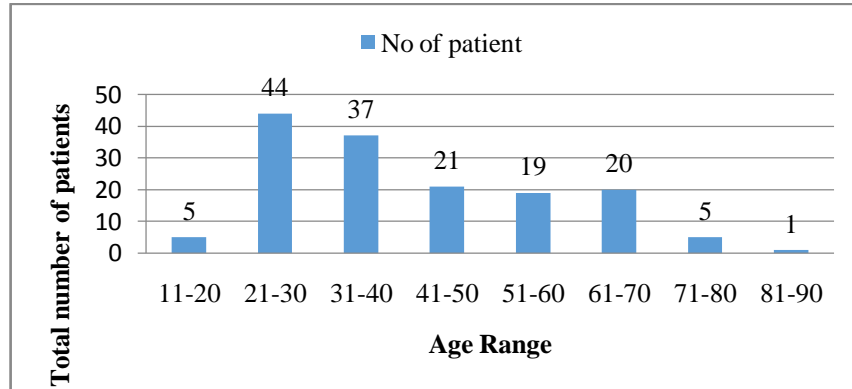


Fig. 1. Bar diagram representing the relation between age and number of TB infected patients

3.2 Sex ratio of MTB patients

This study revealed equation gender distribution of MTB incidence among the target study group of Sirajganj. While, MTB was evident among old aged

males (age group of 51-70), younger female patients (age group of 21-30) were found MTB positive.

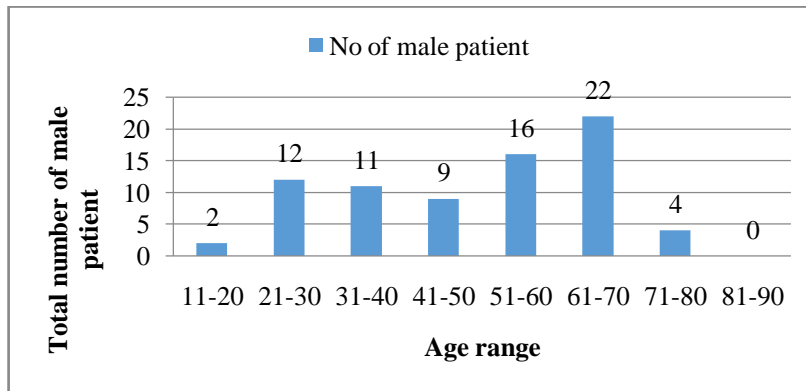


Fig.2. Bar diagram representing the relation between age and gender (male) of TB infected patients

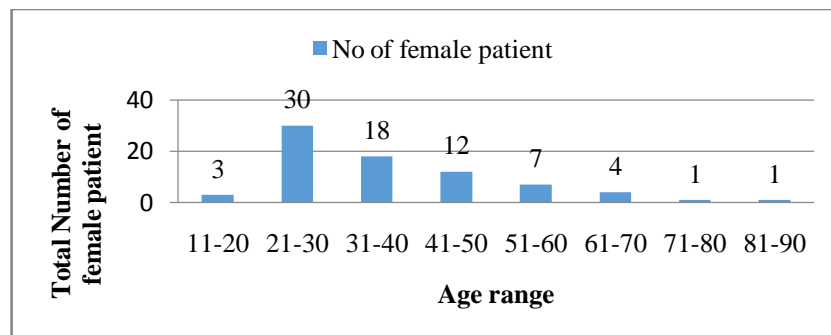


Fig.3. Bar diagram representing the relation between age and gender (female)of TB infected patients

3.3 Correlation of IgG and IgM with MTB infection

The correlation coefficient between number of patient who were IgG and IgM positive were 0.99 and 0.6 respectively. This indicated that, TB patient contain high amount of IgG and low amount of IgM.

4. Discussion:

TB is considered as one of the leading death infectious disease across worldwide. This disease is an indicator of poverty and inequality. The incidence of TB depends upon the gender and age of a person (Global tuberculosis report, 2018; Fu *et al.*, 2020). Also the amount of Ig G and Ig M antibodies work as markers to detect tuberculosis (Welch, Lawless, and Litwin 2012). In this study, MTB detection method named Immunochromatographic (ICT) method was used which is a rapid diagnostic test method and depicted the patterns and prevalence of tuberculosis which is based on several factors regarding age, gender and amount of antibodies in patient blood. Primary confirmation of the presence of TB was confirmed by ICT test kit device.

Firstly, the present study found that, MTB patient was prominent in the age 21-30 maximum and in near range with the age of 31-40 (**Fig 1**). Young patients of Sirajganj district were in severe threat. A recent study revealed that, adolescent and young aged are severely vulnerable by the emergence of tuberculosis (Laycock, Enane and Steenhoff 2021). Another study showed that at least 20% of adolescents and young people die from TB (Houben and Dodd 2016). The reasons behind sufferings include the frequent and wide range social contacts, dissemination of TB germs from infected individuals (Morabia 2014). Mental illness, tobacco using, diabetes, HIV infection, health complications during pregnancy and childbirth are also responsible for the cause (Mathad and Gupta 2012; Rendell *et al.* 2016). However, according to a survey conducted in Taiwan, old aged people found more susceptible, almost thousand times more vulnerable to MTB infection (Fu *et al.* 2020). In this research work, 38% patient (152 out of 400) was found TB positive which is a significant proportion.

Secondly, according to our study, male with the age of 51-70 was in extreme risk (**Fig. 2**). A group of Brazilian scientist, collected data from households

The possibilities of both antibodies' being positive among TB patient were 0.4, very low compared to each individually.

mostly. They found that old male are more vulnerable compared to young male and nearly 66% household are MTB positive in Brazil (Fernandes *et al.* 2018). The reasons account for the scenario are social mixing and gatherings, closeness, household and unprotected sex (Fernandes *et al.* 2018). In our study, the result indicated young women being most susceptible in comparison with other age (**Fig. 3**). A study about worldwide TB ratio about female also found burgeoning TB cases in female specially who were HIV positive (Perumal, Naidoo, and Padayatchi 2018). Above all of that, there's a fact that there is age and gender disparity about TB patients. Geographic distribution reflects the positive result. In some cases, TB positive male patient was found higher than female (Bangladesh, Portugal) (Salim *et al.*, 2004; Marçôa *et al.*, 2018) and reverse scenario was also observed in different studies (Salim *et al.*, 2004; Marçôa *et al.*, 2018). Age disparity remained also prominent in several places (Fu *et al.* 2020).

The current investigation confirmed the higher amount of IgG and lower IgM in positive patients. Most of the study performed about the amount of antibody in TB patient exerts the same result too. In an experiment, infected and non-infected patient's blood was collected and examined the presence of different antibodies in their blood. They found a significant variations and showed significant change in IgG amount while; IgM level remained the same. They also concluded using IgG as marker for TB patients (Abebe *et al.* 2018). Another study, where sample was collected from USA confirmed the same result too (Welch, Lawless and Litwin, 2012).

5. Conclusion

Tuberculosis still remains a menace not only in Bangladesh but also throughout the world. This study found that young female and old male is more vulnerable to tuberculosis. Old people should maintain personal hygiene and need cautious to prevent TB infection because of their poor body condition. However, immune evasion by tuberculosis agent can

boost the infection risk in case of young female patient. This study suggests that factors underlying increased TB infection should be strictly monitored and appropriate measures should be taken to control TB infection.

6. Authors Contributions

Research concept-Mohammad Zakerin Abedin and Muhammad Irfanul Islam, Research design-Muhammad Irfanul Islam, Supervision-Abdullah Akhtar Ahmed & Mohammad Zakerin Abedin, Materials-Md. Faisal Kabir, Data collection-Md. Faisal Kabir, Data analysis and Interpretation-Suranjana Sikdar, Sajjad Hossen Chowdhury & Noor-E-Kashif Farnaz, Literature search- Muhammad Irfanul Islam & Suranjana Sikdar, Writing article-Suranjana Sikdar, Critical review-Md. Babul Aktar, Article editing-Muhammad Irfanul Islam, Final approval- All authors.

7. Acknowledgements

We thank all the staffs of the Khwaja Yunus Ali Medical College and Department of Microbiology at Khwaja Yunus Ali University for their contribution in specimen collection and analysis. Our immense gratitude is expressed to Md. Faisal Kabir, chief biochemist KYAMCH to help us in data collection.

8. Conflict of interests

The authors declare that there are no conflicts regarding publication of this article.

9. Ethical Statement

Institutional ethical clearance was taken from the ethical committee of Khwaja Yunus Ali University before executing the research.

10. Funding support

Research Grant Committee, Khwaja Yunus Ali University funded for this study.

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Citation: Islam MI, Kabir MF, Aktar MB, Sikdar S, Farnaz NEK, Chowdhury SH, Ahmed AA, and Abedin MZ. (2022). Prevalence and Patterns of Tuberculosis infection by Immunochromatographic Technique in a Tertiary Care Hospital in Sirajganj. *KYAU Journal*.5(1):12-17