

Original Article

The Prevalence of Rifampicin Resistance in Mycobacterium Tuberculosis Patients Using Genexpert in Tertiary Medical College and Hospital

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ABSTRACT

Objective: In this study our main goal is to evaluate rifampicin resistance in mycobacterium tuberculosis using GeneXpert in tertiary Medical College and Hospital.

Method: This cross-sectional study was done at tertiary medical college and hospital at Dhaka from November 2020 to April 2021, where 60 clinically suspected or documented tuberculosis cases were selected as a sample population.

Results: During the study, more than fifty percent (56.0%) of the patients were in the age group 20-40 years and 52% were male. About 35% of the patients had history of smoking. 13% patients delayed their treatment to initiate greater than 30 days and 8% cases treatment was incomplete. According to prevalence of drug resistance, results show that 5% Rifampicin (RIF) resistant cases detected by GeneXpert MTB/RIF were phenotypically confirmed as DR strains. Besides that, majority resistance cases were found in male, 66.7%. **Conclusion:** From our

study we can say that, the emergence of drug resistance in TB poses a significant threat to TB control activities throughout the world. Xpert MTB/high RIF's sensitivity and specificity for RIF resistance detection support its use as an initial diagnostic test for RIF resistance. As a result, implementing molecular approaches for direct diagnosis of DRTB as part of routine analysis in health care institutions' laboratories would be extremely beneficial in adapting treatment regimens and limiting the spread of DR TB strains.

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Keywords: Drug resistance (DR), tuberculosis (TB), multiple drug resistance (MDR)

INTRODUCTION

In Bangladesh, tuberculosis (TB) is still a severe public health problem caused by a single infectious pathogen.¹ Current estimates show that one person becomes ill every two minutes and one person dies every 10 minutes. Bangladesh is predicted to have around 300,000 new TB cases and 70,000 fatalities each year, and the nation ranks fifth on the global list of high TB burden countries.^{1,2} In these TB conditions another challenge arise more concern is drug resistance which is the reduction in effectiveness of a medication such as an anti-microbial in treating a disease.³ The term is used in the context of resistance that pathogens have "acquired", that is, resistance has evolved. Antimicrobial resistance challenge clinical care and drive research. When an organism is resistant to more than one drug, it is said to be drug-resistant.⁴

Every year, around 400,000 new cases of MDR-TB are reported worldwide.³ MDR-TB prevalence in South East Asia is predicted to be 2.8 percent (95 percent CI, 1.9 to 3.6) among new cases and 18.8 percent (95 percent CI, 13.3 to 24.3) among previously treated cases, while it is expected to be 1.6 percent - 5.2 percent in India and 0-21.6 percent in Pakistan.⁴

⁵ During evaluation, drug-resistant tuberculosis (DR-TB) is characterized by drug resistance to rifampicin (RIF) commonly, which is rising respectably.

Currently, less than 10% of multi-drug resistant tuberculosis (MDR-TB) cases in the world are detected.⁶

The rapid detection of M. tuberculosis in infected patients is essential for disease management. During the past few years, molecular methods have been developed to identify drug resistance causing gene mutations.⁷⁻⁸

One of the latest techniques is GeneXpert MTB/RIF, which can detect mutations in the rpoB gene only; due to close association of RIF resistance and MDR TB, this

technique has been used to detect MDR TB cases.⁹ The technique has been thoroughly evaluated and used in many countries. It has a sensitivity and specificity of 90.4% and 98.4%, respectively.¹⁰⁻¹¹

OBJECTIVE

- In this study, our main goal is to evaluate rifampicin resistance in mycobacterium tuberculosis patients using GeneXpert in tertiary Medical College and Hospital.

METHODOLOGY

This cross-sectional descriptive type study was carried out at Medicine departments of Tertiary medical college and hospital at Dhaka from November 2020 to April 2021. 60 clinically suspected or documented TB cases were selected as a sample population. An absolute confidentiality of the patient's vital information was maintained for ethical purposes and an ethical approval was obtained from the institution in which the study was carried out. The following variables was collected through an administered questionnaire during sample collection: sex, age, treatment history (new or previously treated). After identifying suspected or documented cases, samples were referred to the laboratory for GeneXpert MTB/RIF for diagnosis. GeneXpert MTB/RIF positives were repeated.

Data entry, quality control and data cleaning had been done following standard method. All data forms and questionnaires had been checked for errors and necessary correction had been made before data entry. Data had been entered using data entry program with built in range and consistency checks (SPSS-23). The prevalence rate had been determined by simple percentages.

RESULTS

In table-1 shows distribution of the patients according to age and gender where more than fifty percent (56.0%) of the patients

were in the age group 20-40 years and 30.0% of the patients were in age group 20 and below while only 14.0% of the patients were in the age group above 40 years. Also, male and female ratio of the patients was almost equal. The following table is given below in detail-

Table-1: Distribution of the patients according to age and gender.

Age group, years	%
20 and below	30%
20-40 years	56%
above 40 years	14%
Gender	%
Male	52%
Female	48%

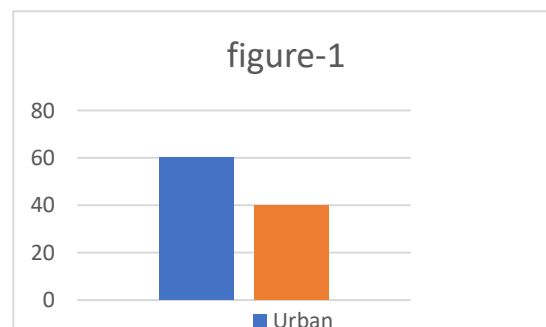
In table-2 shows distribution of respondents by occupation. More than one fourth of the respondents were day laborer(28.0%) and 24.0% of the respondents were students and housewife while 14.0% of the respondents were employee. The following table is given below in detail:

Table-2: Distribution of respondents by occupation

Occupation	Percentage
Day laborer	28%
Students	24%
housewife	24%
Employee	14%
Businessman	6%
Unemployed	2%
Retired	2%

In figure-1 shows distribution of respondents by residence. 60% of the respondents resided in the urban area and 40% were in the rural. The following figure is given below in detail:

Figure-1: Distribution of respondents by residence



In table-3 shows distribution of respondents by smoking history and diabetic status. About 35% of the patients had history of smoking and 45% had diabetic. The following table is given below in detail:

Table-3: Distribution of respondents by smoking history and diabetes mellitus

Smoking history	Percentage
Yes	35%
No	65%
Diabetes Mellitus	Percentage
Yes	45%
No	55%

In table-4 shows distribution of the patients according to status of TB where 44% treated TB in the past followed by 53% patients delayed their treatment to initiate greater than 60 days and 55% cases treatment was incomplete. The following table is given below in detail:

Table-4: Distribution of the patients according to status of TB

	%
Treated for TB in the past	
Yes	13%
No	87%
Delay in initiating TB treatment	
<30 days	13%
>30 days	87%
TB in organs other than lungs	
Yes	6%
No	94%
Treatment incomplete	

Yes	8%
No	92%

In figure-2 shows distribution of the patients according to prevalence of drug resistance. Results show that 5% Rifampicin (RIF) resistant cases detected by GeneXpert MTB/RIF were phenotypically confirmed as DR strains. The following figure is given below:

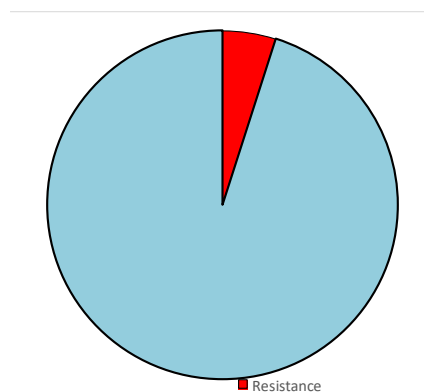


Figure-2: Distribution of the patients according to prevalence of drug resistance

In table-6 shows distribution of gender according to Rifampicin (RIF) resistant where majority resistance cases were found in male, 66.7%. The following table is given below in detail:

Table-6: Distribution of gender according to Rifampicin (RIF) resistant, n=3

Gender	Rifampicin (RIF) resistant, n (%)
Male	2(66.7%)
Female	1(33.3%)

Pattern of DR-TB among different category of Tuberculosis patients identified that 100% cases were DR-TB in category re-treatment failure and it was 0% in new cases.

DISCUSSION

Besides the major biological factors leading to the prevalence of DR-TB, such as the fitness of drug-resistant mycobacterium TB

strains, mutation ability and virulence variation related service patterns have a significant impact on the development of MDR-TB.⁷ Not surprisingly, re-treatment was identified as the strongest association with DR-TB, which is consistent with previous studies.^{3,8,9}

Poor outcomes of previous treatments and the relapse of TB might have contributed to the high prevalence of MDR-TB. China has a very high relapse rate of TB. The TB relapse rate of patients in Shanghai was reported to be 61.5%. This would inevitably lead to prolonged treatment and increase the chance of developing MDR-TB.¹⁰

There found a similar kind of study for rifampicin resistance detection, if the pooled accuracy estimates for Xpert® MTB/RIF are applied to a hypothetical cohort of 1000 individuals where 15% of those with symptoms are rifampicin resistant, Xpert® MTB/RIF would correctly identify 143 individuals as rifampicin resistant and miss eight cases, and correctly identify 833 individuals as rifampicin susceptible and misclassify 17 individuals as resistant. Where 5% of those with symptoms are rifampicin resistant, Xpert® MTB/RIF would correctly identify 48 individuals as rifampicin resistant and miss three cases and correctly identify 931 individuals as rifampicin susceptible and misclassify 19 individuals as resistant. Where as in our study we found 5% were RIF resistant, which was totally reassemble to Steingart, K. R., et al. study.¹¹

Masenga SK et al. also demonstrated that GeneXpert identified 9 (5.9%) instances of rifampicin-resistant TB out of a total of 152 cases of TB at Livingstone Central Hospital (LCH) in 2015, which is comparable to our findings.¹² Other published research are also identical to this one.^{13,14} However, a research undertaken in India and Ghana reported a significantly lower and greater proportion, respectively.^{15,16}

CONCLUSION

From our study we can say that, the emergence of Drug resistance in TB poses

a significant threat to TB control activities throughout the world. Xpert MTB/high RIF's sensitivity and specificity for RIF resistance detection support its use as an initial diagnostic test for RIF resistance. As a result, implementing molecular approaches for direct diagnosis of DR TB as part of routine analysis in health care institutions' laboratories would be extremely beneficial in adapting treatment regimens and limiting the spread of DR TB strains.

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