ORIGINAL RESEARCH PAPER

Pulmonary Medicine

CARTRIDGE BASED NUCLEIC ACID AMPLIFICATION TEST (CBNAAT): A NEW TOOL IN DIAGNOSIS OF TUBERCULOSIS

KEY WORDS: MDR-TB, Smear, CBNAAT

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ABSTRACT

BACKGROUND- To evaluate the role of CBNAAT and smear microscopy by Ziehl-Neelsen (ZN) staining in the diagnosis of Tuberculosis (TB) **METHODS-** This was a record based study conducted at of Respiratory medicine, Sardar Patel Medical College, Bikaner & District TB clinic Bikaner Rajasthan, India. The study was conducted from 1 April 2014 to 31 March 2019. A total of 18468 sputum samples from all the patients record were included in the study. Sputum AFB for ZN staining and CBNAAT were processed. RIF resistance was detected by CBNAAT. The resistance was not detected by ZN staining. **RESULTS-** Out of 18468 sample, 7517 (40.70%) sputum samples were positive by smear microscopy and in CBNAAT out of 18468, 8666 (46.92%) were diagnosed and out of them 5.13% cases were MDR TB diagnosed by CBNAAT. **CONCLUSION-** CBNAAT is a very useful and rapid test for diagnosis of TB and especially in Pediatrics, PLHA with TB, Cancer patients & organ transplant patients. The main advantage of CBNAAT lies in its rapid diagnostic ability and early detection of RIF resistance. It also helps to avoid injudicious use of anti-TB drugs.

INTRODUCTION

TB has been a major global public health problem from times immemorial. World Health Organization (WHO) estimates shows that globally there are 8.6 million incident cases of TB of which 80% are in 22 countries, with India ranked as the highest burden country.[1]

Pulmonary Tuberculosis (PTB) continues to be an important cause of preventable mortality in both developing and developed nations. Early diagnosis and treatment remains the cornerstone of TB control. [1] The two types of clinical manifestation of tuberculosis (TB) are pulmonary TB (PTB) and extrapulmonary TB (EPTB). The former is most common. EPTB refers to TB involving organs other than the lungs (e.g., pleura, lymph nodes and meninges). A patient with both PTB and EPTB is classified as a case of TB.[1]

Globally, the average rate of decline in the TB incidence rate was 1.6% per year in the period 2000 2018, and 2.0% between 2017 and 2018. The cumulative reduction between 2015 and 2018 was only 6.3%, considerably short of the End TB Strategy milestone of a 20% reduction between 2015 and 2020. The global reduction in the total number of TB deaths between 2015 and 2018 was 11%, also less than one third of the way towards the End TB Strategy milestone of a 35% reduction by 2020.[2]

Early diagnosis and treatment remains the cornerstone of TB control. Smear microscopy is the cornerstone for the diagnosis of TB in resource-limited settings; it has only modest (35-80%) sensitivity and a poor Positive Predictive Value (PPV).[2] Mycobacterial culture, though is gold standard, usually takes 2-6 weeks for final result and requires technical expertise. [3] Chest X-ray is useful but is not specific for diagnosing PTB. Also, TB may show symptoms and atypical radiologic findings, indistinguishable from those of community-acquired pneumonia . [4] Quick and accurate detection of the pathogen with its drug susceptibility patterns is vital for treatment initiation and disease control. [5] Rapid molecular tests (CBNAAT) are recent diagnostic tools that can be used to simultaneously test for TB and RIF resistance with higher sensitivity than sputum smear microscopy and which could replace conventional culture-based drug susceptibility testing.[6]

The CBNAAT detects the presence of TB bacilli and also tests for resistance to RIF. CBNAAT, as it is a very cost-effective and rapid test is likely to revolutionize the diagnosis and treatment of PTB.[7] CBNAAT is a highly specific test as it uses 3 specific primers and 5 unique molecular probes to target the rpoB gene of Mycobacterium tuberculosis, which is the critical gene associated with RIF resistance. With the above background, the present study was undertaken to evaluate the role of CBNAAT in the diagnosis of PTB.

MATERIALS AND METHODS

This was a record based study conducted at Respiratory medicine, Sardar Patel Medical College, Bikaner & District TB clinic Bikaner Rajasthan, India. The study was conducted from 1 April 2014 to 31 March 2019. A total of 18468 sputum samples from all the patients record were included in the study. All sample were examined by CBNAAT for detection of M. tuberculosis and RIF resistance as per Revised National Tuberculosis Control Program (RNTCP) guidelines.

Data analysis-All data were analyzed by Epi-info software.

RESULTS

Table no. 1. Socio-demographic profille

Mean age	39.21±20.56 Yrs
Male : Female	12788 : 5680

Table no. 2 Sputum smear results

Lab results	No of patients	95 % CL
Negative	10951	39.99-41.42%
Scanty	587	0.87-1.11%
1+	4487	24.12-25.38%
2+	2356	12.51-13.49%
3+	87	0.48-0.57%
Total	18468	

Table no. 3 CBNAAT Result

Lab results	No of patients	95 % CL
Negative	9802	52.59-55.06%
Positive	8666	47.61-44.94%
Total	18468	

Table no..4. CBNAAT

Lab results	No of patients	95 % CL
Resistance	1095	5.84-6.55%
Sensitive	7571	94.16-93.45%
Total	8666	

Table 5. Comparison of sputum smear and CBNAAT

Test	No of sputum examined	Positive results
Sputum smear	18468	7517
CBNAAT	18468	8666

DISCUSSION

India accounts for around one-fourth of the global TB cases. Detection of AFB in sputum smear is a simple, rapid, inexpensive and very specific diagnostic tool for PTB. However, its major limitation is low sensitivity.

The World Health Organisation (WHO) has endorsed the use of CBNAAT as a rapid diagnostic test for the diagnosis of TB and prioritised areas like drug-resistant TB, paediatric TB, TB-HIV co-infection, extra-pulmonary TB, and sputum smear-negative PTB for use of CBNAAT.[8]

In this study, mean age of TB patients was 39.21±20.56 years with male preponderance.

Dewan R et al.,[9] in their study found that mean age of patients was 35±9 years; 69% of were in 20-40 years age group and 76% were males.

Our study shows sensitivity of conventional sputum smear microscopy by ZN staining was very low. Geleta DA et al.,[10] have also found a very low sensitivity (9.3%) of sputum smear for AFB.

Sensitivity of CBNAAT varied significantly between 100% in sputum smear-positive PTB and 15.00% in sputum smear-negative PTB. In studies conducted by Mukherjee S et al.,[9] and Geleta DA et al.,[10] showed similar results of very high sensitivity of CBNAAT in smear positive cases have been reported.

Mohanty T et al.,[11] and Dewan R et al.,[9] reported sensitivity of 32% and 32.58% of CBNAAT in smear negative PTB, which correlates with present study. RIF resistance was detected in two (1.86%) cases of PTB.

CONCLUSION

CBNAAT is a very useful and rapid test for diagnosis of TB and especially in Pediatrics, PLHA with TB, Cancer patients & organ transplant patients. The main advantage of CBNAAT lies in its rapid diagnostic ability and early detection of RIF resistance. It also helps to avoid injudicious use of anti-TB drugs.

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