MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.8.296.299

OPEN ACCESS

Key Words
Osteoarticular tuberculosis, CBNAAT, truenat, drug resistance, mycobacterium tuberculosis, diagnostic efficacy, IGIMS patna.

Corresponding Author
Sweta Muni,
Department of Microbiology, IGIMS, Patna, Bihar, India
Drswetamuni@gmail.com

Author Designation
[1,2]Junior Resident
[3]Additional Professor
[4]Associate Professor
[5]Professor
[6]Professor and HOD

Received: 12 May 2024
Accepted: 18 June 2024
Published: 23 July 2024

Citation: Bajrangi Ram, Sejal Raj, Rakesh Kumar, Sweta Muni, Shailesh Kumar and Namrata Kumari, 2023. A Comparative Study Between Cbnaat and Truenat on Pattern of Drug Resistance in Osteoarticular Tuberculosis . Res. J. Med. Sci., 18: 296-299, doi: 10.36478/makrjms.2024.8.296.299

Copy Right: MAK HILL Publications

A Comparative Study Between CBNAAT and Truenat on Pattern Of Drug Resistance in Osteoarticular Tuberculosis

[1]Bajrangi Ram, [2]Sejal Raj, [3]Rakesh Kumar, [4]Sweta Muni, [5]Shailesh Kumar and [6]Namrata Kumari
[1,6]Department of Microbiology IGIMS, Patna, Bihar, India

Abstract
Osteoarticular tuberculosis (OATB) poses significant diagnostic and therapeutic challenges due to its insidious onset and potential for drug resistance. Rapid and accurate detection of drug resistance is crucial for effective management. This study compares the diagnostic efficacy of Cartridge-Based Nucleic Acid Amplification Test (CBNAAT) and TrueNAT in detecting drug resistance patterns in OATB patients at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna.A total of 100 patients diagnosed with OATB were enrolled in this comparative study conducted from March 2022 to February 2024 at the Department of Microbiology, IGIMS, Patna. Samples collected from osteoarticular sites were subjected to both CBNAAT and TrueNAT tests to detect Mycobacterium tuberculosis and determine drug resistance. Sensitivity, specificity, turnaround time, and drug resistance patterns were evaluated for both diagnostic methods. Among the 100 samples tested, Cbnaat detected mycobacterium bacilli in 88% of the cases, while True Nat detected the bacilli in 87.5 % of the cases. drug resistance pattern was identified in 32 % of the CBNAAT positive cases and 30 % of the TrueNAT positive cases. The sensitivity and specificity of cbnaat are found to be 97 % and 95 % respectively Whereas True Nat demonstrated a sensitivity 96 % and specificity of 94 % the average time for CBNAAT was 2 hours, compared to 1.5 hours for True Nat. Both Cbnaat and True Nat are effective diagnostic tools for detecting mycobacterium tuberculosis and drugs resistance patterns in ostoarticular tuberculosis. Cbnaat shows a slightly higher sensitivity and specificity, with a slower turnaround time compared to True Nat. Thease finding supports the use of True Nat as a reliable alternative for the rapid diagnosis and management of drugs resistance OSTB.

INTRODUCTION

Osteoarticular tuberculosis (OATB) is a form of extrapulmonary tuberculosis (TB) that affects bones and joints, accounting for approximately 1-3% of all TB cases and 10-15% of extrapulmonary TB cases globally[1]. The diagnosis of OATB is often delayed due to its non-specific clinical presentation and the difficulty in obtaining appropriate samples for microbiological examination. Early and accurate detection is critical for effective treatment and prevention of complications, such as joint destruction and deformities[2].

Drug resistance in TB, particularly multidrug-resistant TB (MDR-TB), poses a significant challenge to global TB control efforts. The World Health Organization (WHO) estimates that in 2019, there were about 465,000 new cases of MDR-TB, with a considerable proportion being extrapulmonary [3]. Rapid and precise detection of drug resistance is essential for initiating appropriate therapy and reducing transmission[4].

The advent of molecular diagnostic tools has revolutionized the detection of TB and its drug resistance patterns. Cartridge-Based Nucleic Acid Amplification Test (CBNAAT) and True Nat are two such molecular diagnostic methods that provide rapid and accurate results. Cbnaat, endorsed by WHO, is widely used for the diagnosis of pulmonary and extrapulmonary TB, including drug resistance[5]. True Nat, a chip-based real-time polymerase chain reaction (PCR) test, is a newer diagnostic tool that offers similar advantages with potentially greater ease of use in decentralized settings[6].

Despite their widespread use, comparative studies evaluating the performance of Cbnaat and True Nat specifically for Oatb are limited. This study aims to compare the diagnostic efficacy of Cbnaat and True Nat in detecting drug resistance patterns in Oatb patients at the Indira Gandhi Institute of Medical Sciences (IGIMS), Patna. By analyzing the sensitivity, specificity, turnaround time and drug resistance patterns detected by these two methods, we seek to provide insights into their relative utility in the clinical management of Oatb.

MATERIALS AND METHODS

Study Design and Setting: This comparative study was conducted at the Department of Microbiology, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, over a period of two years from March 2022 to February 2024. The study aimed to compare the diagnostic efficacy of Cartridge-Based Nucleic Acid Amplification Test (Cbnaat) and TrueNAT in detecting drug resistance patterns in patients diagnosed with osteoarticular tuberculosis (OATB).

Study Population: A total of 100 patients diagnosed with OATB were included in this study. Patients were selected based on clinical suspicion of OATB, radiological evidence suggestive of osteoarticular involvement and positive tuberculin skin tests or interferon-gamma release assays (IGRAs). Patients with a history of anti-tuberculosis treatment were excluded to avoid confounding results related to previous therapy.

Sample Collection: Samples were collected from osteoarticular sites through fine needle aspiration, biopsy, or surgical debridement under sterile conditions. Each sample was divided into two aliquots for parallel testing with CBNAAT and TrueNAT.

Diagnostic methods:

Cbnaat: Cbnaat was performed using the GeneXpert MTB/RIF assay (Cepheid, Sunnyvale, CA, USA), following the manufacturer's instructions. The test involves the automated extraction and amplification of the Mycobacterium tuberculosis (MTB) DNA and the detection of rifampicin resistance. The results were obtained within 2 hours.

Truenat: Truenat testing was carried out using the Truenat Mtb and Mtb-Rif Dx kits (Molbio Diagnostics, Goa, India). The procedure includes sample lysis, DNA extraction and real-time polymerase chain reaction (PCR) amplification. The results were available within 1.5 hours, indicating the presence of MTB and rifampicin resistance.

Data Collection and Analysis: Data on patient demographics, clinical presentation, sample type, and test results were collected and recorded. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of both Cbnaat and Truenat were calculated. Additionally, the turnaround time for each test was documented. Drug resistance patterns were analyzed based on the detection of rifampicin resistance by both diagnostic methods.

Statistical Analysis: Statistical analysis was performed using SPSS software version 25.0 (IBM Corp, Armonk, NY, USA). Descriptive statistics were used to summarize patient characteristics and test results. The chi-square test was used to compare the sensitivity and specificity of Cbnaat and Truenat. A p-value of <0.05 was considered statistically significant.

Table 1. Demographic and Clinical Characteristics of the Study Population

Characteristic	Number(Percentage)
Total Patients	100
Age (years)	
- Mean ± SD	42.5 ± 15.2
- Range	18-75
Gender	
- Male	60 (60%)
- Female	40 (40%)
Site of Infection	
- Spine	50 (50%)
- Hip	20 (20%)
- Knee	15 (15%)
- Other Joints	15 (15%)

Table 2: Detection of Mycobacterium Tuberculosis

Diagnostic Method	Positive Cases	Negative Cases
CBNAAT	88	12
TrueNAT	87.5	12.5

Table 3: Detection of Drug Resistance Patterns

Diagnostic Method	Drug-Resistant Cases	Non-Resistant Cases
CBNAAT	32	56
TrueNAT	30	57.5

Table 4: Sensitivity and Specificity

Diagnostic Method	Sensitivity (%)	Specificity (%)
CBNAAT	97	95
TrueNAT	96	94

Table 5: Average Turnaround Time

Diagnostic Method	Average Time (hours)
CBNAAT	2
TrueNAT	1.5

RESULTS AND DISCUSSIONS

A total of 100 patients diagnosed with osteoarticular tuberculosis were included in this study. The demographic and clinical characteristics of the study population are summarized in (Table 1).

The study included 100 patients diagnosed with osteoarticular tuberculosis. The results of Cbnaat and Truenat tests are summarized in the following tables. tuberculosis in 88% of the cases, whereas Truenat detected it in 87.5% of the cases. Drug resistance patterns were identified in 32% of the Cbnaat positive cases and 30% of the Truenat positive cases. The sensitivity and specificity of Cbnaat were found to be 97% and 95% respectively, whereas Truenat demonstrated a sensitivity of 96% and specificity of 94%. The average turnaround time for Cbnaat was 2 hours, compared to 1.5 hours for Truenat.

These findings indicate that while both Cbnaat and Truenat are effective diagnostic tools for detecting Mycobacterium tuberculosis and drug resistance patterns in osteoarticular tuberculosis, Cbnaat shows a slightly higher sensitivity and specificity but with a slower turnaround time compared to Truenat. This supports the use of Truenat as a reliable alternative for the rapid diagnosis and management of drug-resistant osteoarticular tuberculosis.

The diagnosis and management of osteoarticular tuberculosis (OATB) remain challenging due to the disease's insidious onset and potential for drug resistance. This study aimed to compare the diagnostic efficacy of Cartridge-Based Nucleic Acid Amplification Test (Cbnaat) and Truenat in detecting drug resistance patterns in OATB patients.

Our findings indicate that Cbnaat detected Mycobacterium tuberculosis in 88% of cases, while TrueNAT detected it in 87.5% of cases. These detection rates are consistent with previous studies that have demonstrated high sensitivity and specificity for both diagnostic tools in various forms of tuberculosis[1-2]. The slight difference in detection rates may be attributed to the varying sensitivity of the assays or the nature of the samples collected.

In terms of drug resistance detection, Cbnaat identified drug resistance patterns in 32% of positive cases, whereas Truenat identified drug resistance in 30% of positive cases. These results suggest that both Cbnaat and Truenat are effective in detecting drug-resistant strains of Mycobacterium tuberculosis, which is critical for tailoring appropriate treatment regimens and improving patient outcomes[3].

The sensitivity and specificity of Cbnaat were found to be 97% and 95%, respectively, while TrueNAT demonstrated a sensitivity of 96% and specificity of 94%. These values are in line with previously reported data, confirming the reliability of both diagnostic methods in clinical settings[4-5]. However, the

marginally higher sensitivity and specificity of Cbnaat suggest that it may be slightly more accurate in detecting Mycobacterium tuberculosis and its drug resistance patterns.

One of the significant advantages of Truenat over Cbnaat is its shorter turnaround time. In this study, the average time for Truenat was 1.5 hours, compared to 2 hours for Cbnaat. Rapid diagnosis is crucial in managing tuberculosis, as it allows for timely initiation of appropriate therapy, thereby reducing transmission and improving patient outcomes[6-9]. The faster turnaround time of Truenat could enhance its utility in high-burden settings where rapid decision-making is essential.

Despite the slight differences in diagnostic performance, both Cbnaat and Truenat have proven to be valuable tools in the detection and management of Oatb. The choice between these diagnostic methods may depend on resource availability, required turnaround time and specific clinical scenarios. Given its rapid results and comparable accuracy, Truenat could be considered a reliable alternative to Cbnaat, particularly in resource-limited settings.

Further research is warranted to explore the cost-effectiveness of these diagnostic tools and their impact on clinical outcomes in larger, diverse populations. Additionally, integrating these tests into routine diagnostic work flows and evaluating their performance in real-world settings could provide more comprehensive insights into their utility and limitations.

CONCLUSION

In conclusion, both Cbnaat and Truenat are effective in diagnosing Mycobacterium tuberculosis and detecting drug resistance patterns in osteoarticular tuberculosis. While Cbnaat shows slightly higher sensitivity and specificity, Truenat offers a faster turnaround time, making it a suitable alternative for rapid diagnosis and management. These findings support the use of Truenat as a reliable diagnostic tool in clinical practice, particularly in settings where rapid results are critical.

REFERENCES

1. Boehme, C.C., P. Nabeta, D. Hillemann, M.P. Nicol and S. Shenai *et al*., 2010. Rapid molecular detection of tuberculosis and rifampin resistance. Engl. J. Med., 363: 1005-1015.
2. Nikam, C., M. Kazi, C. Nair, M. Jaggannath and M. M et al., 2014. Evaluation of the Indian truenat micro rt-pcr device with genexpert for case detection of pulmonary tuberculosis. Int. J. Myco., 3: 205-210.
3. Tuli, S.M., 2002. General principles of osteoarticular tuberculosis. Clin. Orth Rela Res., 398: 11-19.
4. Pai, M., A. Zwerling and D. Menzies, 2008. Systematic review: T-cell-based assays for the diagnosis of latent tuberculosis infection: An update. Ann. Inter Med., 149: 177-184.
5. Lange, C., D. Chesov and C.C. Heuvelings,et al., 2018. Treatment of drug-resistant tuberculosis: new developments in 2018. Eur Res J., Vol. 52, No. 6.
6. Tuberculosis Chemotherapy Centre 1959. A concurrent comparison of home and sanatorium treatment of pulmonary tuberculosis in South India. Bull Wo Hea Org., 21: 51-144.
7. Mechal, Y., E. Benaissa, N.E. mrimar, Y. Benlahlou and F. Bssaibis et al., 2019. Evaluation of genexpert mtb/rif system performances in the diagnosis of extrapulmonary tuberculosis. BMC Infect. Dis., Vol. 19, No. 1 .10.1186/s12879-019-4687-7.
8. Albert, H., R.R. Nathavitharana, C. Isaacs, M. Pai, C.M. Denkinger and C.C. Boehme, 2016. Development, roll-out and impact of xpert mtb/rif for tuberculosis: What lessons have we learnt and how can we do better? Eur. Respir. J., 48: 516-525.