Vol. 5 No. 2 Year 2024
jurnal.umj.ac.id/index.php/MMJ
mmjfkk@umj.ac.id
e-issn: 2721–317X
Muhammadiyah Medical Journal

Research Article

Comparison of GeneXpert Results of Adult Pulmonary Tuberculosis (TB) Patients with Human Immunodeficiency Virus (HIV) without HIV Infection at three private hospitals in Jakarta

Muhammad Fachri[1*], Salsabila Widya Pramesti[2], Risky Akaputra[1], Fitri Yanti[3]

[1]Department of Pulmonology Respiratory, Medicine Faculty of Medicine and Health, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia
[2]Medical Study Program, Faculty of Medicine and Health, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia
[3]General Practitioners, Jakarta Islamic Hospital Pondok Kopi, Jakarta, Indonesia

*Corresponding author: dr.muhammadfachri@gmail.com

ABSTRACT

Background: Tuberculosis (TB) is a bacterial infection caused by Mycobacterium TB. According to the International Standard for TB Care (ISTC), Human Immunodeficiency Virus (HIV) is one of the main comorbidities in TB. **Purposes**: To compare the positivity rate of GeneXpert in diagnosing TB to suspected TB adult patients with and without HIV infection at three private hospitals in Jakarta. **Methods:** This study uses a cross-sectional approach; the data comes from medical records. The sampling technique in this research uses the cluster sampling formula. The inclusion criteria in this study were adult pulmonary TB patients more than 18 years of age, patients with pulmonary TB, and patients who had complete medical record data, and the exclusion criteria were patients who did not have GeneXpert examination results and adult pulmonary TB patients who did not have laboratory results of HIV Rapid test results. Statistical analysis using the Chi-Square statistical test. **Results:** A total of 24 adult pulmonary TB patients with HIV and positive GeneXpert were identified, whereas 13 adult TB patients with HIV and positive GeneXpert were identified, and pulmonary TB patients without HIV and positive GeneXpert numbered 59, while those with positive GeneXpert numbered 15. There is a tendency for fewer positive GeneXpert values in Adult Pulmonary TB patients with HIV compared to those without HIV Infection. Statistically not significant ($p > 0.05$) **Conclusion:** Adult pulmonary TB patients without HIV tend to have higher positive GeneXpert test results than adult pulmonary TB patients with HIV, and there is no statistically significant relationship.

Keywords: GeneXpert, human immunodeficiency virus, pulmonary tuberculosis.

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by the fungal pathogen Mycobacterium tuberculosis (Mtb). It spreads through the respiratory system and usually affects the lungs, except for the pleura (lining of the lungs), but can affect any tissue. Smoking is one of the risk factors for TB. According to the International Standard for TB Care (ISTC) HIV is one of the main comorbidities in TB in addition to DM. One of the ISTC criteria requires every TB patient

to examine their family members to determine the source of transmission if a TB case is found. This is especially important for children under the age of five and family members with immunologic diseases, including HIV, diabetes, renal impairment, etc (1).

Indonesia ranks among the top ten countries worldwide as the top TB contributor, with 67% in 2019 and 2020. Most of the estimated increase in TB deaths globally is attributable to four countries: India, Indonesia, Myanmar, and the Philippines. Ten countries collectively accounted for 75% of the global disparity between the estimated TB incidence and the number of individuals newly diagnosed with TB in 2021. India, Indonesia, the Philippines, Pakistan, and Nigeria comprise the top five contributors, with respective contributions of 24%, 13%, 10%, 6.6%, and 6.3% (2).

The greater mortality rate in People Living with HIV/AIDS with tuberculosis is mainly due to two factors. First, as HIV-associated immunosuppression worsens and serious illnesses, mainly disseminated tuberculosis, become more prevalent, tuberculosis will progress more rapidly. Second, with fewer bacteria in sputum found in the lung cavity and a higher prevalence of extra-pulmonary disease, diagnosis becomes more difficult (3). The objective of this study is to compare the gene expert findings in adult pulmonary tuberculosis patients with combined HIV disease with the gene expert findings in adult pulmonary tuberculosis patients without HIV disease.

METHODS

This study employs a cross-sectional approach and an analytical observational method; the data comes from secondary data, namely from medical records on inpatients and outpatients who are contaminated with TB with HIV and without HIV at the Jakarta Islamic Hospital Cempaka Putih, Sukapura, and Pondok Kopi Period September 2021 - November 2023. The data collected included the results of geneXpert, Rapid HIV, and CD4 values. The population in this study were inpatients and outpatients contaminated with TB at the Jakarta Islamic Hospital Cempaka Putih, Sukapura, and Pondok Kopi. The sampling technique in this research uses the cluster sampling formula, which determines samples by taking sample representatives from each hospital and must meet the inclusion and exclusion criteria.

The inclusion criteria in this study were adult pulmonary TB patients over 18 years of age, patients with pulmonary TB, and patients with complete medical record data and numbers. In contrast, the exclusion criteria were patients who did not have gene Xpert examination results, adult pulmonary TB patients over 18 years of age who did not have laboratory results or HIV Rapid test results, and patients who did not have complete medical record data and numbers. Univariate analysis using a table describing inpatients and outpatients contaminated with TB, such as age, gender, patient type, symptoms, and treatment results. Bivariate analysis using the Chi-Square statistical test. IBM SPSS Statistics version 26 (IBM Corporation) was employed for all calculations. This study has been submitted to the Ethics Committee of the Faculty of Medicine and Health, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia (No. 207/PE/KE/FKK-UMJ/XI/2023) and to the Ethics and Research Committee of the Jakarta Islamic Hospital Cempaka Putih, Sukapura, and Pondok Kopi, Jakarta, Indonesia.

RESULTS

Table 1 shows that of the 111 samples of characteristics of inpatients and outpatients with confirmed TB at the Jakarta Islamic Hospital Cempaka Putih, Sukapura, and Pondok Kopi. The most common gender is male in TB with HIV (73%) and in adult pulmonary TB patients without HIV are (59.5%). The age group with the highest prevalence of active pulmonary tuberculosis in both HIV-positive and HIV-negative adult patients is between 25 and 34 years. Among adult pulmonary tuberculosis (TB) patients with HIV and TB patients without HIV, the majority were new patients. The majority of treatment outcomes in both groups were complete and successful.

Table 1. Baseline Characteristics of Adult Pulmonary TB Patients

Basic Characteristics		TB Patients with HIV	%	TB patients without HIV	%
Gender	Male	27	73 %	44	59.5 %
	Female	10	27 %	30	40.5 %
Age	18 – 24	4	10.8 %	13	17.6 %
	25 – 34	13	35.1 %	17	23 %
	35 – 44	8	21.6 %	13	17.6 %
	45 – 54	9	24.3 %	13	17.6 %
	55 – 65	2	5.4 %	10	13.5 %
	>65	1	2.7 %	8	10 %
Patient Type	New	30	81.1 %	61	82.4 %
	Relapse	6	16.2 %	12	16.2 %
	Failure	0	0	0	0
	Discontinued Treatment	1	2.7 %	1	1.4 %
	Transfer	0	0	0	0
	Other cases	0	0	0	0
Treatment Outcome	Recovered	7	18.9 %	18	2.3 %
	Treatment completed	17	45.9 %	46	62.2 %
	Failure	1	2.7 %	0	0
	Died	0	0	2	2.7 %
	Default	0	0	0	0
	Move	0	0	1	1.4 %

Likewise, in table 2 there is no significant difference between *geneXpert* results in adult pulmonary patients with HIV and without HIV. It is known that the p value = 0.091 ($p > 0.05$) which means that there is no significant relationship between *geneXpert* examination and rapid HIV test examination in TB patients with HIV and without HIV.

Table 2. Relationship between *geneXpert* in HIV- and non-HIV-associated adult pulmonary TB patients

Chi Square Test	*GeneXpert* Result		P value
	Positive	Negative	
Pulmonary TB with HIV	24	13	0.091
Pulmonary TB without HIV	59	15	

DISCUSSION

The study revealed a higher incidence of pulmonary tuberculosis (TB) cases in males (64%) compared to females (36%), among all adult TB cases identified during the study period. These findings align with the study conducted by Fachri et al, 2021 to a significant extent of 44.4% (4). It is related to the level of activity and work as a productive force that allows it to be easily infected with bacteria that cause TB (5). In addition to work, according to other studies explain that there is a relationship between smoking and the incidence of pulmonary TB. People who have a history of smoking are 3.2 times more at risk of developing pulmonary TB compared to people who do not have a history of smoking (6).

In the research conducted at RSIJ Cempaka Putih, Sukapura, and Pondok Kopi, it was found that inpatients and outpatients with confirmed TB with HIV and without HIV were mostly aged 25-34 years (35.1%, 23%). The results of this study are in accordance with research (7) as much as (58.03%). This is consistent with the idea that young adulthood is a time of experience, risk-taking, and freedom. Therefore, HIV infection among young people can begin with dabbling in activities such as drug use, alcohol consumption, and unsafe sexual behavior such as having sex with multiple partners (8).

Distribution based on patient type showed that the majority of patients found in this study were new patients (78.4%). This result is in accordance with the research of Ruth Haryanti Sihotang et al, 2013 who has 91.38% (9). Regarding treatment outcomes, this study revealed that a significant proportion of patients (56.8% in all adult pulmonary TB cases during the study period) achieved full treatment coverage at the conclusion of their treatment phase. The obtained result aligns with the findings of Teferi et al. (2021), which reported a percentage of 54.3% (10) but is different from the results of Sri Melati et al. research at Persahabatan Hospital which determined that the most favorable treatment outcomes were achieved in Multi drug resistant TB patients was default (34.5%) (11). The high default rate in Multi drug resistant TB cases is probably caused by the development of depression, anxiety, and socio-economic stress during the treatment phase of multi-drug resistant tuberculosis therapy (12).

The results of *geneXpert* examination in all adult pulmonary TB cases contained in the study period showed that the examination results with positive results (Rifampicin Resistant / Rifampicin Sensitive / Rifampicin Indeterminant) were higher (74.8%) than the examination results with negative results (25.2%). These findings are consistent with the study of Fadhilah NA et al, 2023, positive results (89.1%) and negative results (10.9%). Positive results Rifampicin Sensitive More (69.4%) in accordance with the results of research Fadhilah NA et al by (81.6%) (13). The results are also in accordance with the study of Guenaoui et al, 2016; 21 (42%) were resistant to Rifampicin, while 29 (58%) were sensitive to Rifampicin (14) This is similar to that reported by Trivedi et al, 2002 and Shah et al, 1988 where (37.3%) and (37.47%) were resistant to Rifampicin respectively (15,16), but lower than the study of

Chowgule et al, 1998 who reported a very high incidence of Rifampicin resistance of (66.8%) (17). This level of resistance is higher than the studies of Rasaki et al, 2014 (18), Olusoji et al, 2013 (19), Lawson et al, 2010 (20), Ganguly et al, 2015 (21). Where (7.2%), (8.6%), (19%), (29.87%) isolates were resistant to Rifampicin respectively and Idigbe et al, 1998 (22) who reported only 2% resistance to Rifampicin in Lagos, Nigeria. However, no Rifampicin resistant strains were reported in the findings of Rasaki et al, 2014 (18).

Mycobacterium tuberculosis strains may be susceptible to rifampicin due to their potent bactericidal activity. As a result, these isolates exhibit elevated levels of resistance to streptomycin and ethambutol, which are less effective. The recent history of Rifampicin use, particularly in African countries, is also frequently cited as a probable explanation for the low frequency of resistance to rifampicin (23).

In this study, there was no statistically significant relationship between HIV rapid test examination, which is one of the diagnostic criteria for HIV, and the results of *geneXpert* examination in pulmonary TB patients. Examination using the GeneXpert method can diagnose rifampicin drug-resistant TB with a percentage of 96.1% (24), meaning that this study also revealed an association between HIV infection and anti-TB drug resistance. control sample - used in research with a case-control design. According to Widiastuti et al, 2017, there was no statistically significant relationship (p=0.50) between the incidence of MDR-TB and a history of HIV/AIDS (25). Meanwhile, Bhadke BB, et al, 2017 (26) showed that there was a significant difference between HIV infection and Mycobacterium tuberculosis detection ($p<0.005$), as well as a significant difference in Rifampicin resistance in seropositive and seronegative patients. In contrast, a previous study by Fachri et al, 2018 (27) compared adult pulmonary TB with type 2 Diabetes mellitus and HIV TB. Acid-fast basil examination results in adult pulmonary tuberculosis patients were significantly correlated with random blood glucose, fasting blood glucose, 2 hour postprandial blood glucose, and type 2 diabetes mellitus disease. Because HIV disease and type 2 diabetes mellitus disease are the two primary comorbidities associated with pulmonary tuberculosis.

This lack of association could also be due to the fact that more Multi drug resistant TB cases were not tested for HIV-AIDS, and the percentage difference between cases and controls was very small and more Multi drug resistant TB suspects did not undergo HIV/AIDS testing (28). Another reason is that the time between HIV infection and the appearance of HIV antibodies varies from person to person, so there are several other factors that may contribute to the onset of Multi drug resistant TB. HIV-positive people usually have faster disease progression and faster reactivation of infection than HIV-negative people, who often experience reactivation of latent infection that has been dormant for decades (25,28).

The research limitations of this study are not all adult pulmonary TB patients who seek treatment at the Jakarta Islamic Hospital Cempaka Putih, Sukapura, and Pondok Kopi pulmonary clinics have laboratory test results for rapid HIV testing, the small sample of pulmonary TB patients who had positive HIV rapid test results. Hospitals should be able to conduct HIV rapid test diagnostic examinations on every adult pulmonary TB patient. It is anticipated that TB patients with Rapid Positive HIV tests will undergo CD4 checks. Further research should be conducted using radiological images to compare adult pulmonary TB patients who are accompanied by HIV to those who are not and this study found some

incomplete medical record data so that researchers hope to pay more attention to the completeness of the medical record of each patient so that further research can be more effective and efficient.

CONCLUSION

Adult pulmonary TB patients without HIV tend to have higher positive *geneXpert* test results than adult pulmonary TB patients with HIV and there is no statistically significant relationship.

ACKNOWLEDGMENTS

We would like to thank the staff of Jakarta Islamic Hospital, Sukapura, Cempaka Putih, Pondok Kopi and the Faculty of Medicine and Health, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia for technical support for this study.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

1. Perhimpunan Dokter Paru Indonesia. Tuberkulosis Pedoman Diagnosis dan Penatalaksanaan di Indonesia. Perhimpunan Dokter Paru Indonesia. 2021;1: 1–78.
2. World Health Organizations. Global Tuberculosis report. 2022. Available from: http://apps.who.int/bookorders
3. Meintjes G, Brust JCM, Nuttall J, Maartens G. Management of active tuberculosis in adults with HIV. lancet HIV. 2019 Jul;6(7):e463–74.
4. Fachri M, Fauzi RA, Akaputra R. Gambaran Radiologi Foto Toraks Pasien TB Paru Resistan Obat dengan dan Tanpa DM Tipe 2 di Rumah Sakit Islam Jakarta Sukapura. J Kedokt dan Kesehat. 2021;17(2):177.
5. Utami PR, Amelia N, Susanto V, Adfar TD. Pemeriksaan GeneXpert Terhadap Tingkat Positivitas Pemeriksaan Basil Tahan Asam (BTA) Metode Ziehl Neelsen Pada Penderita Suspek TB Paru. J Kesehat PERINTIS (Perintis's Heal Journal). 2021;8(1):82–90.
6. Camila F. Hubungan Kondisi Lingkungan Rumah dengan Kejadian Tuberkulosis di Wilayah Kerja Puskesmas Tamansari Kota Tasikmalaya Tahun 2022. Universitas Siliwangi; 2022.
7. Wikanningtyas TA, Hatta M, Massi MN, Pratiwi I, Fachri M, Bahrun U, et al. Hematologic parameters in pulmonary tuberculosis patients based on the microscopic sputum examination. Enfermería Clínica [Internet]. 2020;30:243–6. Available from: https://www.elsevier.es/es-revista-enfermeria-clinica-35-articulo-hematologic-parameters-in-pulmonary-tuberculosis-S1130862119304541
8. Baedowi A, Zulfian, Rusmini H, Prasetia T. Hubungan Jumlah Viral Load dengan Kejadian TBC pada Pasien HIV/AIDS yang Mendapatkan Terapi ARV. Arter J Ilmu Kesehat. 2020 May 30;1(3 SE-Articles).
9. Sihotang RH, Benny S. Lampus, Pandelaki AJ. Gambaran Penderita Tuberkulosis Paru yang Berobat Menggunakan DOTS di Puskesmas Bahu Malalayang I Periode Januari-Desember 2012. J Kedokt Komunitas dan Trop. 2013;1(1):69–72.

10. Teferi MY, Didana LD, Hailu T, Woldesenbet SG, Bekele S, Mihret A. Tuberculosis treatment outcome and associated factors among tuberculosis patients at Wolayta Sodo Teaching and Referral Hospital, Southern Ethiopia: a retrospective study. J Public health Res. 2021 Apr;10(3).
11. Munir SM, Nawas A, Soetoyo DK. Pengamatan Pasien Tuberkulosis Paru dengan Multidrug Resistant (TB-MDR) di Poliklinik Paru RSUP Persahabatan. J Respirologi Indones. 2010;30(2):1 of 13.
12. Caceres N de A, Vieira MMC, Vieira IF, Monteleone VF, Neto LJM, Bonafe S. Opportunistic infections in AIDS. Aust J Med Sci. 1996;17(4):159–60.
13. Fadhilah NA, Muflihah H, Maharani W. Kesepakatan Hasil Pemeriksaan Tes Cepat Molekuler (TCM) dengan Pemeriksaan Mikroskopik Basil Tahan Asam (BTA) dalam Penegakkan Diagnosis Tuberkulosis Paru. Bandung Conf Ser Med Sci. 2023;3(1):1013–20.
14. Guenaoui K, Harir N, Ouardi A, Zeggai S, Sellam F, Bekri F, et al. Use of GeneXpert Mycobacterium tuberculosis/rifampicin for rapid detection of rifampicin resistant Mycobacterium tuberculosis strains of clinically suspected multi-drug resistance tuberculosis cases. Ann Transl Med. 2016 May;4(9):168.
15. Trivedi SS, Desai SG. Primary antituberculosis drug resistance and acquired rifampicin resistance in Gujarat, India. Tubercle. 1988 Mar;69(1):37–42.
16. Shah AR, Agarwal SK, Shah K V. Study of drug resistance in previously treated tuberculosis patients in Gujarat, India. Int J Tuberc lung Dis Off J Int Union against Tuberc Lung Dis. 2002 Dec;6(12):1098–101.
17. Chowgule R V, Deodhar L. Pattern of secondary acquired drug resistance to antituberculosis drug in Mumbai, India--1991-1995. Indian J Chest Dis Allied Sci. 1998;40(1):23–31.
18. Rasaki S, jibola A, Musa S, Moradeyo A, Odeigah L, Abdullateef S, et al. Rifampicin Resistant Tuberculosis in a Secondary Health Institution in Nigeria, West Africa. J Infect Dis Ther. 2014 Apr 26;2:1–5.
19. Olusoji D, Osman E, Oladimeji O, Dairo O. Pre-extensive drug resistant tuberculosis (Pre-XDR-TB) among MDR-TB patents in Nigeria. Glob Adv Res J Microbiol. 2013 Feb 11;2.
20. Lawson L, Habib AG, Okobi MI, Idiong D, Olajide I, Emenyonu N, et al. Pilot study on multidrug resistant tuberculosis in Nigeria. Ann Afr Med. 2010;9(3):184–7.
21. Ganguly J, Ray S, Nandi S, Halder S, Kundu S, Mandal A. A study to evaluate pattern of rifampicin resistance in cases of sputum positive pulmonary tuberculosis. J Evol Med Dent Sci. 2015 Apr 3;4:4762–8.
22. Idigbe O, Sofola T, Akinosho R, Onwujekwe D, Odiah F, Okoye R. Initial drug resistance tuberculosis amongst HIV seropositive and seronegative prison inmates in Lagos, Nigeria. In: Int Conf AIDS. 1998. p. 137.
23. Otu A, Umoh V, Habib A, Ameh S, Lawson L, Ansa V. Drug resistance among pulmonary tuberculosis patients in Calabar, Nigeria. Pulm Med. 2013;2013.
24. Suriani Simarmata O, Bisara Lolong D, UpayaKesehatan Masyarakat P, Litbangkes B. Pemanfaatan Tes Cepat Molekuler (TCM) Genexpert Sebagai Alat Diagnostik TB Paru

di RSUD Wangaya Kota Denpasar. 2020;135–48.

25. Widiastuti EN, Subronto YW, Promono D. Faktor risiko kejadian multi drug resistant tuberculosis di RSUP Dr. Sardjito. Ber Kedokt Masy. 2017;33(7):325.
26. Bhadke BB, Rathod RK, Mulay SD, Deshmukh DG, Mahajan PD. Efficacy of genexpert in diagnosing MTB / RIF resistance in HIV seropositive and seronegative patients: a study in comparison. Int J Med Microbiol Trop Dis. 2017;3(2):50.
27. Fachri M, Hatta M, Abadi S, Santoso SS, Wikanningtyas TA, Syarifuddin A, et al. Comparison of acid fast bacilli (AFB) smear for Mycobacterium tuberculosis on adult pulmonary tuberculosis (TB) patients with type 2 diabetes mellitus (DM) and without type 2 DM. Vol. 23, Respiratory medicine case reports. England; 2018. p. 158–62.
28. Hendewi A, Lubis H. Hubungan Koinfeksi Tuberkulosis dan Human Immunodeficiency Virus (HIV) Serta Kaitannya dengan Multi Drug Resistant Tuberculosis (MDR-TB) di Kota Medan Tahun 2019. J Ilm Kohesi. 2021 Jul 19;5(3 SE-Articles).