

Research Article

Characteristic Overview of Drug-Sensitive Pulmonary Tuberculosis Patients with Type 2 Diabetes Comorbidity in Elderly That Visited RSUD R Syamsudin SH Kota Sukabumi from January 2022 to October 2023

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ABSTRACT

Background: Tuberculosis (TB) is a global health issue, with over 10 million cases worldwide, and Indonesia ranks as the second-highest country with TB cases. The comorbidity of diabetes mellitus (DM) increases the risk of TB, especially in elderly patients. TB patients with DM are challenging to treat, have low cure rates, and increase the risk of multi-drug resistance TB. **Purpose:** To understand the characteristic overview of elderly patients with drug-susceptible pulmonary tuberculosis along with type 2 diabetes. **Method:** This descriptive research utilized surveys with primary data from interviews with elderly patients at RSUD R Syamsudin SH and secondary data from the hospital, covering January 2022 to October 2023. **Results:** Out of 33 respondents, 20 were male and 13 female. Most (81.8%) had education up to high school, and 72.7% were unemployed. According to BMI, 36.4% had normal weight. Regarding drug adherence, 75.8% supervised it. All respondents had positive chest X-rays for TB, and 87.9% tested positive in molecular rapid tests. Random blood sugar levels showed 12 patients below 200 mg/dl. Among those tested for HbA1c, 78.8% did not undergo the exam, and 6.1% had levels <8%. **Conclusion:** TB DM predominantly affects elderly males. Most respondents were high school graduates, unemployed, and had normal BMI. They often took on the role of supervising drug adherence. In the Glucose Ad Random, more individuals had levels above 200, and among those tested for HbA1c, many exceeded 7%. All patients showed TB-consistent chest X-rays, with most testing positive in rapid molecular tests.

Keywords: drug-sensitive pulmonary TB, elderly, type 2 DM

INTRODUCTION

In *the Global Tuberculosis Report* (2022), *the World Health Organization* (WHO) estimates that there are more than 10 million cases of tuberculosis (TB) in the world with an estimate of TB cases that will increase by around 3.6% in the period 2020 – 2021 (1). TB disease spreads quickly in people who have a suppressed immune system (2). Decreased immunity in patients

with Diabetes Mellitus (DM) is caused by increased blood sugar and reduced insulin levels, thus affecting and disrupting the function of chemotaxis, phagocytosis, and antigen-presenting cells (3). TB treatment in DM patients is often unsuccessful and is more likely to reactivate compared to TB cases in those who do not have diabetes, this causes an increased risk of developing multidrug resistance TB in TB patients with

DM (4). In TB patients with DM, TB can cause glucose intolerance and worsen the sufferer's glycemic control. The prognosis for pulmonary TB patients will not be good if the patient has uncontrolled DM (5).

High blood glucose levels in DM patients are considered an important factor in susceptibility to TB infection. In a healthy body condition, the immune system can fight the Mycobacterium tuberculosis bacteria so that it does not infect people who come into contact with TB patients. However, in patients with uncontrolled DM, the impact of type 2 DM damages the function of macrophages, lymphocytes, and monocytes. Diabetes can also cause failure in the TB treatment (3). Based on research that has been carried out, the treatment of TB patients with DM who do not recover is 72.2%, while only 27.8% recover. On the other hand, for non-DM, the recovery rate was 86.5% and for those who did not recover, it was 13.5%. This is due to the hepatotoxic effect of the combination of TB and DM drugs (6).

Decreased immunity can also occur in the elderly, this is called immunosenescence. Immunosenescence can cause elderly people to experience reduced vaccine effectiveness. Age is one of the factors that can cause a person to get TB. According to research conducted, by Maryuni (2019), several risk factors may increase the risk of a DM patient becoming infected with TB, such as gender, living in an urban area, old age, suffering from DM for a long time, HbA1c $\geq 7\%$, low BMI, close contact with TB patients, have a history of smoking, crowded housing conditions, employment, income level, low economy, and treatment compliance (7). Based on the tests that have been carried out, there is a relationship between treatment compliance, high HbA1C,

experiencing DM for a long time, and a history of close contact with TB patients with the incidence of TB in DM patients. Meanwhile, according to research conducted by Yosephine et al.(2021), there is a relationship between age, gender, and nutritional status in TB sufferers labeled DM (8).

Elderly TB patients have a higher mortality rate than TB patients aged under 65 years (9), and TB patients with DM may have an increased risk of developing multidrug-resistant TB (10). Therefore, TB in elderly patients must be immediately detected whether they have DM so that there is no delay in treatment because it can increase the risk of developing MDR (11). TB patients with DM have a high risk of mortality during treatment and there is a risk of TB relapse after completion of treatment. TB can reappear due to decreased cellular immunity in DM sufferers which results in a reduction in Th-1 lymphocytes which results in the production of TNF- α , IL-1 β and IL-6 also decreased (12).

This study aimed to further analyze the characteristics of elderly patients with Drug-sensitive TB and comorbid type 2 DM.

METHODS

This type of research is descriptive with a survey method using primary data obtained from a list of questions obtained door to door or direct interviews at the R Syamsudin SH Regional Hospital polyclinic and also secondary patient data in the form of the identity of TB patients who visited the R Syamsudin SH Regional Hospital, Sukabumi City. The population in this study were elderly patients with TB who visited RSUD R Syamsudin SH Sukabumi City from January 2022 to

October 2023. Data were collected in the period November-December 2023. The samples included were elderly patients aged ≥ 60 years who had comorbid diabetes mellitus type 2 and suffered from tuberculosis who came to RSUD R Syamsudin SH for treatment and were willing to be respondents. Meanwhile, the exclusion criteria are elderly people whose medical record data is incomplete and who are not cooperative to become respondents.

The data that has been collected is then processed using SPSS version 29. Patient characteristics (Gender, Age, Education, Employment Status, body mass index (BMI), TB examination, blood sugar examination, and role of medication supervisor) are analyzed univariately and presented in the form of a frequency distribution table. This research has been approved by the Health Research Ethics Committee, Faculty of Medicine and Health, Muhammadiyah University, Jakarta with ethics number 193/PE/KE/FKK-UMJ/XI/2023.

RESULTS

Based on data and interviews obtained with elderly people in the working area of RSUD R Syamsudin SH, the following results were obtained:

Table 1. Distribution of data on the characteristics of elderly TB DM respondents

Variable (n = 33)	Frequency (n)	Percentage (n)	Median (min-max)	Mean
Gender				
Man	20	60.6%		
Woman	13	39.4%		
Age				
Elderly	27	81.8%	65	66.48
Old Elderly	6	18.2%	(60-88)	
Education				
Elementary school	6	18.2%		
Junior High School	6	18.2%		

Senior School S1	High	19	57.6%		
Job status					
Still working		9	27.3%		
No longer working		24	72.7%		
BMI					
Underweight		2	6.1%	21.6	22.01
Normal		12	36.4%	(13.3 –	2
At risk of obesity		9	27.3%	31.1)	
Obese 1		6	18.2%		
Obese 2		4	12.1%		
The Role of Medication Monitoring					
There is		25	75.8%		
There isn't any		8	24.2%		

Table 2. TB examination and patient blood sugar examination

Inspection	Frequency (n)	Percentage (%)
Chest photo		
In accordance	33	100%
It is not in accordance with	0	0
BTA sputum		
Positive	0	0
Negative	0	0
Do not do	33	100%
mWRD Test		
Positive	29	87.9%
Negative	4	12.1%
Do not do	0	0%
Glucose Ad		
Random		
<200	12	36.4%
≥ 200	21	63.6%
HbA1c levels		
<6.5%	1	3.0%
$\geq 6.5\%$	6	18.2%
Do not do	26	78.8%

Based on Table 1, of the 33 respondents, 27 (81/8%) were elderly and 6 were elderly (18.2%). Respondents had a variety of educational backgrounds ranging from elementary school to bachelor's degrees. A total of 9 (27.3%) respondents were still working and 24 respondents (72.7%) were no longer working. All respondents had been declared positive for tuberculosis and suffered from type 2 diabetes mellitus by doctors. Characteristics of respondents based on BMI found 2 respondents (6.1%) with

underweight BMI, 9 respondents (27.3%) with BMI at risk of obesity, 6 people (18.2%) with BMI obese I, and 4 people (12.1%) with BMI obese 2. As seen from the medication-taking supervisors there were 25 respondents (75.8%) who admitted to having a drug-swallowing supervisor role.

Based on Table 2, TB examination, and chest x-rays of all respondents (33 patients (100%) were declared positive for TB. Patients who came for treatment to R Syamsudin SH Regional Hospital did not undergo BTA sputum examination because the hospital uses a molecular rapid test as the golden standard, then the examination 29 people (87.9%) tested positive for the molecular rapid test and 4 people (12.1%) had negative results. When examining blood sugar levels, 12 patients had blood sugar below 200mg/dl and 21 patients had blood sugar ≥ 200 mg. /dl, blood sugar levels were checked when they came for the examination. When checking the HbA1c levels, 26 patients (78.8%) did not do it and of the patients who did the HbA1c tests, it was found that 1 respondent (3.0%) had an HbA1c level < 6.5 . % and 6 respondents (18.2%) ≥ 6.5 %.

DISCUSSION

In Table 1, characteristics based on age show that male patients with pulmonary TB with comorbid type 2 DM numbered 20 respondents, where the number of male patients was greater than female patients, totaling 13 respondents. This is in line with research conducted by Fauziah et al (2016) which discusses why the incidence of TB and type 2 DM in men is greater than in women, it can be influenced by the smoking habit which is mostly done by men so it can reduce the respiratory tract immune system. which makes men more susceptible to

tuberculosis, this is because cigarette smoke can damage phagocyte cells in the respiratory system so that the antigen response can decrease (13).

Based on age, it was found that the number of respondents was much greater among the elderly, namely with 27 respondents, while there were only 6 respondents for the elderly. In individuals over 40 years of age, changes in the body's physiological function can quickly occur which can disrupt the function of the body's endocrine system to produce insulin (14). Then the body's immunity of an elderly person can also decrease with age, this causes a decrease in the ability of the body's organs to fight M. Tuberculosis germs (14).

Based on education, it was found that the majority of respondents had a high school education, namely 19 respondents (57.6%), this was not in line with research conducted by Novita and Ismah (2017) where it was found that the largest number of TB DM patients had an elementary school education, 20 people (50%). According to Novita and Ismah, education may be related because the majority of jobs in the research they conducted were laborers (15). However, in this study, this could be due to low public knowledge and awareness regarding treatment so that more patients had at least a high school education, as explained by Muhammad Emir 2019 the higher a person's education, the higher the level of awareness of their own health and also the more developed their mindset because they can easily absorb various information so that prevention and treatment can be carried out well (16).

Based on employment status, 24 respondents were no longer working for various reasons, such as being old, sick, and others. Research conducted by Annisa

(2015) shows that there is no significant relationship between the incidence of pulmonary TB and work because work does not have a major influence on the growth and proliferation of *M. Tuberculosis*, although work can determine income and income can determine where one lives. However, it was also explained in the research that it is hoped that working can reduce the risk of contracting TB bacteria because workers have relatively little time to stay at home, which will reduce the intensity of contact with TB sufferers in the same house (17).

Based on BMI, the majority of pulmonary TB and type 2 DM sufferers had Normal BMI, namely 12 respondents (36.4%) and the least were Underweight, 2 people (6.1%). This is in line with research conducted by Fauziah (2016) where in the study there were 15 patients with Normoweight or 71%, according to Fauziah this could be due to the weight loss experienced along with the course of the disease. Because overweight is one of the risk factors for DM and weight loss is one of the symptoms of Tuberculosis, many TB sufferers accompanied by type 2 DM have a Normal or Normoweight BMI (13).

Finally, in Table 1, based on the role of medication-taking supervisor, it was found that 25 respondents had the role of medication-taking supervisor and 8 respondents admitted to taking medication without the role of medication-taking supervisor. The role of the medication-taking supervisor referred to in this study is the role of someone other than the patient such as a family member or nurse who monitors whether the medicine is taken or not. In research conducted by Permatasari (2021), it was stated that the role of a medication-taking supervisor is very supportive of a TB patient's compliance

with taking medication. Even though the drug swallowing supervisor's role is only to supervise and remind patients to take medication, the drug swallowing supervisor's role can provide positive results, namely the patient's recovery. In the research, there were 99 respondents and it was stated that 99 respondents (100%) routinely took anti-tuberculosis medication regularly as directed. by doctors, 99 respondents (100%) never forgot to take anti-tuberculosis medication, and 99 respondents (100%) continued to take medication even though the drug swallowing supervisor did not remind their (18).

Then in the results of Table 2 of this study, there are 2 examinations carried out, namely the mWRD test and chest X-ray. RSUD R Syamsudin SH uses a rapid molecular test as the main examination so sputum BTA examinations are rarely carried out, although research conducted by Fachri in 2018 showed that TB patients with comorbid DM had BTA examination results that had a higher positive value, namely (3+/2 +/1+) compared to TB without comorbid DM. Complaints from respondents who came for treatment tended to refer to TB and some were also advised to do mWRD test as TB screening in type 2 DM patients (19). In the chest X-ray examination, the results of the examination were 33 respondents, or 100% of the total respondents who were diagnosed positive and the radiological picture matched the picture of TB. Elycia dan Halim (2020) and 9 respondents did not do it. According to Elycia and Halim, the radiological picture of pulmonary TB with DM shows a different picture from pulmonary TB sufferers without DM, in pulmonary TB sufferers without DM there are usually only infiltrates in the right upper lobe of the lung.

In TB sufferers with DM infiltrates are often found in other lung lobes. And cavities (non-normal pockets) can also be found (20). In the mWRD test examination, 29 people were positive (87.9%) and 4 people were negative (12.1%). Based on DM examination, HbA1c examinations are carried out at least twice a year to see the effects of using pharmacological therapy for 8-12 weeks and to see whether there is a need for changes in therapy. If the HbA1c level shows a value above 7%, this indicates that the patient's blood sugar is not controlled and needs to be done. Evaluation of therapy in patients (15). In this study, the results of the examination of HbA1c levels were obtained with an average of 10.9%. This average value is not much different from research conducted by Wahiduddin, Pranoto & Sudjarwo 2019 by 11.20% but is different from research conducted by Elycia dan Halim (2020) those who obtained an average HbA1c value of 8% (20). Meanwhile, for patients with a Glucose Ad Random value <200 obtained in this study, there were 12 people (36.4%) and there were 21 patients with a Glucose Ad Random value ≥ 200 (63.6%), the Glucose Ad Random examination was carried out as a diagnosis if the patient had classic complaints (polyuria), polyphagia, and polydipsia) or a hyperglycemic crisis has occurred (15). This is different from research conducted by Elycia & Halim 2020 where in the study there were more respondents with a Glucose Ad Random below 200, namely 26 people, compared to respondents with a Glucose Ad Random above 200, namely 24 people (20). This could be because the Glucose Ad Random examination carried out in this study was in blood sugar at any time. The first patient comes for treatment.

CONCLUSION

The occurrence of TB DM is highest in males, with a dominance in the elderly group. Respondents on average were high school graduates, the majority were no longer employed, and most had normal BMI. Respondents on average played the role of drug adherence supervisor. In the Glucose Ad Random, more individuals were recorded with levels above 200. Among respondents who underwent HbA1c examination, more had levels above 7%. All patients exhibited chest X-rays consistent with TB, and the majority tested positive in molecular rapid tests. This research is a cross-sectional study that cannot confirm a causal relationship between whether DM will worsen TB and vice versa.

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CONFLICT OF INTEREST

The researcher has no conflicts of interest and no affiliations or connections with any entity or organization that could raise questions of bias in the discussion and conclusions of the manuscript.

REFERENCES

1. World Health Organization. Global tuberculosis report 2021: supplementary material. World Health Organization; 2022.
2. Sejati A, Sofiana L. Factors in the occurrence of tuberculosis. *J Kesehatan Masy.* 2015;10(2):122-8.

3. Tiara R, Tri A. The relationship between type 2 diabetes mellitus and an increased risk of pulmonary tuberculosis. *Natl Semin Med Res* 2. 2021;2(1):95.
4. Lambara Putra I, Nusadewiarti A, Trijayanthi Utama W. Management of Tuberculosis with Diabetes Mellitus in a 64 Year Old Woman Using a Family Medicine Approach. University of Lampung; 2020.
5. Rohman H. Tuberculosis Cases With a History of Diabetes Mellitus in High Prevalence Areas of Diabetes Mellitus. *Indones J Heal Inf Manag*. 2018 Dec 5;6(2 SE-):149–56.
6. Yanti Z. Effect of Diabetes Mellitus on Successful Treatment of Tuberculosis in Tanah Kalikedinding PHC. *J Berk Epidemiol*. 2017 Oct 27;5(2 SE-Articles):163–73.
7. Maryuni S. Risk Factors for Pulmonary Tuberculosis in Diabetes Mellitus Patients (Case Study at Dr. Kariadi Hospital). Semarang State University; 2019.
8. Yosephine MK, Hardy FR, Wenny DM, Nurrizka RH, Pulungan RM. Factors that influence the incidence of pulmonary tuberculosis in diabetes mellitus sufferers at Hospital X. *J Heal*. 2021 Nov 30;12(3):344–51.
9. Cruz-Hervert LP, García-García L, Ferreyra-Reyes L, Bobadilla-del-Valle M, Cano-Arellano B, Canizales-Quintero S, et al. Tuberculosis in ageing: high rates, complex diagnosis and poor clinical outcomes. *Age Ageing*. 2012;41(4):488–95.
10. Aziz KK. Treatment of Pulmonary Tuberculosis and Diabetes Mellitus and Its Effect on the Risk of Multi-Drug Resistant Tuberculosis (MDR-TB). *Anat Med J*. 2019;2(1):22–32.
11. Jali MV, Kavital A, Hiremath MB. Challenges of diabetes in elderly TB patients. *Indian J Tuberc*. 2022;69:S264–6.
12. Zahro Harahap F. The Relationship between Diabetes Mellitus and Tuberculosis (Case Control Study at Kotapinang Regional Hospital). North Sumatra State Islamic University; 2021.
13. Fauzia DF, Basyar M, Manaf A. Incidence of Pulmonary Tuberculosis in Type 2 Diabetes Mellitus Patients in the Internal Medicine Inpatient Room at Dr. Hospital. M. Djamil Padang. *Andalas Heal J*. 2016 Aug 11;5(2).
14. Kurdi F, Abidin Z, Surya VC, Anggraeni NC, Alyani DS, Riskiyanti V. Incidence Rates of Diabetes Mellitus in Middle Age Elderly During the Covid-19 Pandemic. *Scientific Journal of Nursing*. *Sci J Nurs*. 2021 Oct 1;7(2):282–8.
15. PERKENI. Guidelines for the Management and Prevention of Adult Type 2 Diabetes Mellitus in Indonesia 1st ed. Perkeni. 2021.
16. Ismah Z, Novita E. Study of Characteristics of Tuberculosis Patients at the Seberang Ulu 1 Health Center, Palembang. *Unnes J Public Heal*. 2017 Oct 15;6(4):218–24.
17. Siregar RJ, Yusuf SF, Fernaldy D. The Relationship between Physical Conditions of the House and the Incidence of Tuberculosis. *Int J Public Heal Excell*. 2022;1(1):01–5.

18. Permatasari PAI. The Relationship Between the Role of Monitoring Drug Ingestion and Patient Compliance with Taking Anti-Tuberculosis Drugs in South Denpasar. *Natl Heal Res J.* 2020 Jun 25;4(1):65–9.
19. 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. *Respir Med Case Reports.* 2018;23:158–62.
20. Elycia D, Halim S. Characteristics of type II diabetes mellitus patients with pulmonary tuberculosis at Sumber Waras Hospital in 2016-2018. *Tarumanagara Med J.* 2020 May 15;2(1):20–6.