Associated Factors of the Results of Pulmonary Tuberculosis Treatment During the COVID-19 Pandemic in Makassar City

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Abstract

BACKGROUND: A regimen directly observed treatment-short course is recommended by the World Health Organization as a strategy for controlling tuberculosis (TB).

AIM: This treatment was carried out for 6 months despite the COVID-19 pandemic situation. The purpose of the study was to determine the factors associated with the treatment outcomes of pulmonary TB undergoing treatment during the COVID-19 pandemic, with the research target was Category I pulmonary TB patients.

METHOD: The type of research was observational analytic with a cohort study design. This research was conducted at the Pulmonary Center in October 2020-May 2021 involved 62 samples.

RESULTS: About 75.8% (47 respondents) successfully treated and 24.2% (15 respondents) decided unsuccessful. There was a significant association between diabetes status (p = 0.014), anemia status (p = 0.035), knowledge of TB (p = 0.009), knowledge of COVID-19 (p = 0.014), and family history of COVID-19 exposure (p = 0.011) to the treatment outcomes of pulmonary TB treatment during the pandemic.

CONCLUSION: Associated factors to the outcome of treatment for pulmonary TB patients undergoing TB treatment during a pandemic included diabetes mellitus status, anemia status, knowledge of TB, knowledge of COVID-19, and family history of exposure to COVID-19.

Introduction

Tuberculosis (TB) is an infectious disease that attacks people and causes death [1]. This disease is caused by *Mycobacterium tuberculosis* and can be transmitted through coughing and sneezing. Until now, TB is one of the biggest health problems in the world. This disease causes health problems for millions of people every year; estimated that the cases reach 10.0 million and around 1.3 million deaths [2]. Globally, Southeast Asia contributes 44% of the TB burden, and Indonesia contributes around 8.5% of the TB burden worldwide [2]. Various efforts were conducted to overcome TB, such as the detection and treatment of TB patients. The World Health Organization (WHO) recommends directly observed treatment-short (DOTS) course as a TB control strategy. This strategy focuses on finding and curing TB patients by breaking the chain of TB transmission to reduce the incidence of TB in the community [3].

The fight against TB has alleviated progress in recent years, such as a decrease in the number of deaths due to TB which fell from 1.6 million in 2017 to 1.5 million in 2018, and a decrease in the number of TB deaths by 42% between 2000 and 2018 [4]. However, the COVID-19 Pandemic threatens to reverse the progress made to reduce the burden of TB in the world. The number of deaths from TB globally is increasing, around 0.2–0.4 million in 2020 TB [2]. In addition, there is an increase in TB transmission and delays in TB diagnosis and treatment [5]. A study by Brazil shows that the COVID-19 situation is an important barrier for patients in seeking care. Many patients feel insecure and worried about returning to health services, contributing to the worsening of TB [6]. This can cause patients to be non-adherent in undergoing TB treatment.

The patient underwent TB treatment for 6 months standard treatment, consists of an intensive phase with at least isoniazid (INH), rifampin, and pyrazinamide (PZA), followed by a 4-month continuation phase with at least INH and rifampicin (RIF) [7]. Treatment aims to cure TB patients, prevent death from TB and stop the transmission of TB mycobacterium from the infected to the community around the patient [8]. TB treatment can be a challenge

for patients because it takes a minimum of 6 months to be declared cured [9]. The results of the patient's treatment include recovered, complete treatment, failed treatment, died, and dropped out. Successful treatment can include recovery and complete treatment, while treatment failure includes treatment failure, death, and dropout. Various factors influence treatment outcomes, including marital status, education level, HIV-negative status, treatment category, and knowledge about TB, increasing the chances of successful treatment undertaken by patients [10] (Marian, 2017). A study in Yemen showed that gender and comorbidities were associated with treatment failure [11].

This study aimed to analyze the factors associated with the treatment outcomes of pulmonary TB patients during the COVID-19 pandemic in Makassar City. This research may improve the respondents' understanding of TB disease and health protocols during a pandemic to increase their awareness in undergoing regular treatment until recovered.

Method

This research was an analytic observational with a cohort research design, conducted at the Pulmonary Center in October 2020-May 2021, involved 62 samples. The ethics permit was issued by the Hasanuddin University Ethics Committee, No. 285/UN4.6.5.31/PP36/2020. The inclusion criteria were TB patients diagnosed through rapid molecular test examination, patients undergoing DOT category I, aged between 15 and 64 years, and willing to be respondents. Exclusion criteria included undergoing DOT category 2 treatment and drug-resistant TB patients. The study variables were the dependent variable (outcome of treatment) and the independent variable (body mass index [BMI], DM status, HIV status, knowledge about TB, knowledge of COVID-19, and family history of COVID-19).

Treatment outcomes such as recovery, complete treatment, treatment failure, dropout, and die. Recovery status was based on microscopy examinations carried out in the laboratory; after 6 months of treatment, the patient was declared cured if the smear results were negative. BMI was measured by the patient's weight and height at the first visit to the service; diabetes status revealed through the examination of Temporary Blood Glucose and declared DM positively if blood glucose >200 mg/dl. Furthermore, HIV status was known from a positive VCT examination. At the same time, anemia was examined by hemoglobin (Hb) measurement, positively anemia if the Hb level in adult males was <13 g/dl and adult women were <12 g/dl. Meanwhile, acid-fast bacilli gradation obtained through TCM examination results were low, medium, and high, and lung lesions were obtained on chest radiography. Several variables

were obtained through questionnaires and interviews, including individual factors (age, gender, marital status, occupation, and education level), knowledge of TB, knowledge of COVID-19, and family history of COVID-19.

Results

The initial survey of this study was conducted through observation and interviews when the patient visited the health service, which included age, occupation, education level, gender, marital status, BMI, and measuring patient knowledge about TB, patient knowledge about COVID-19, and history family with COVID-19. Besides, several supporting examinations were carried out, such as radiological examinations, temporary blood glucose examinations, VCT examinations, and rapid molecular tests on patient sputum samples. The results of the study can be shown in Table 1.

Table 1: Characteristics of respondents

Variable	n	%
Age group		
15–24 year	9	14.8
25–34 year	19	31.1
35–44 year	7	11.5
45–54 year	13	21.13
55–64 year	13	21.13
Current occupation		
Civil servant	6	10.0
Lecturer	2	3.3
Private employees	19	31.7
Collage student	3	5.0
Housewife	14	23.3
Does not work	16	26.7
Education level		
Elementary school	10	15.1
Middle school	17	27.4
High school	26	41.9
Bachelor	5	8.1
Graduate	4	6.5
Gender		
Male	39	62.9
Female	23	37.1
Marital status		
Married	41	68.3
Single	19	31.7
Body mass index		
Underweight (<18.5)	21	33.9
Normal (18.5–24.9)	32	51.6
Overweight (>25)	9	14.5
Diabetes mellitus status		
Yes	16	25.8
No	46	74.2
Anemia		
Yes	23	37.1
No	39	62.9
AFB gradation		
Low	31	50.0
Medium	11	17.7
High	20	32.3
Lesion in chest radiology		
Yes	31	50.0
No	17	27.4
Uncheck	14	22.6
Knowledge of TBC		
Good	43	69.4
Less	19	30.6
Knowledge of COVID-19		
Good	46	74.2
Less	16	25.8
Family history of COVID		
Yes	8	12.9
No	55	87.1
Outcomes treatment		
Success treatment	47	75.8
Unsuccessful treatment	15	24.2

AFB: Acid-fast bacilli.

This study was followed up to 6 months of treatment, and the outcomes were measured. The results of the treatment obtained included recovery, complete treatment, dropout, and death. Specifically, treatment outcomes were successful treatment (recovered and complete treatment) and unsuccessful treatment (died and dropped out). The data were then analyzed using the Chi-square test to determine the relationship between the dependent and independent variables with a significant value <0.05. The results of the analysis can be shown in Table 2.

Table 2: Analysis of research variables

Variables	Treatment outcomes		p-value
	Successful treatment n (%)	Unsuccessful treatment n (%)	
Gender			
Male	27 (43.5)	12 (19.4)	0.138
Female	20 (32.3)	3(4.6)	
Diabetes mellitus status			
Yes	8 (12.9)	8 (12.9)	0.014
No	39 (62.9)	7 (11.3)	
Anemia			
Yes	14 (22.6)	9 (14.5)	0.035
No	33 (53.2)	6 (9.7)	
Knowledge of TBC			
Good	37 (59.7)	6 (9.7)	0.009
Less	10 (16.1)	9 (14.5)	
Knowledge of COVID-19			
Good	39 (62.9)	7 (11.3)	0.014
Less	8 (12.9)	8 (12.9)	
Family history of COVID			
Yes	3 (4.8)	5 (8.1)	0.011
No	44 (71.0)	10 (16.1)	

Discussion

The WHO recommends using a regimen directly observed treatment-short course as a strategy for controlling TB. This regimen combines four first-line antibiotics, i.e. INH, rifampin, PZA, and ethambutol (EMB). This treatment includes intensive treatment for 2 months with four first-line TB drugs (INH, RIF, PZA, and EMB), followed by a second phase, namely a follow-up phase for 4 months only with RIF and INH [12]. Treatment outcomes include recovery, complete treatment, treatment failure, drop out and die. This study shows that most of the respondents completed treatment. This is following research conducted by Ali, which showed that respondents with successful treatment outcomes were more than those who did not complete treatment [10]. There are various factors associated with treatment outcomes, such as gender.

The impact of gender on the treatment outcomes of TB patients has been evaluated in previous studies but has revealed inconsistent results. A study in Taiwan reported that gender differences in demographic characteristics and treatment outcomes, including sputum conversion and treatment-related mortality, were analyzed appropriately [13]. In contrast, there were no differences between sex regarding clinical presentation, diagnostic criteria, previous non-adherence to treatment, time from symptom onset,

number of medical appointments before diagnosis, or treatment outcome. Reported in Brazil [14]. This study showed that 37 respondents (62.9%) were male, 12 of whom did not complete treatment. There were 23 respondents (37.1%) female, 20 of them completed treatment. The results of statistical tests showed no significant relationship between gender and the outcome of treatment for pulmonary TB patients (p = 0.138).

Diabetes mellitus is a factor that is also related to the outcome of treatment. Diabetes mellitus is characterized by hyperglycemia resulting from defects in insulin secretion, insulin response, or both (American-Diabetes-Association 2014). Based on the study results obtained data that there were 16 respondents (25.8%) with diabetes mellitus status, eight of whom completed the treatment. Thirty-six respondents (74.2%) did not have diabetes mellitus status, seven of whom did not complete the treatment. The statistical test results showed a significant relationship between diabetes mellitus status and treatment outcomes of pulmonary TB patients (p = 0.014). A study showed that patients with DM had the possibility of delayed sputum conversion and treatment failure (Corona, 2015). Most studies that report DM as a risk factor for treatment failure have failed to report the cause of death, and whether death is due to the severity of TB or the presence of comorbidities caused by DM and exacerbated by older age makes the study unclear [15].

Another factor related to treatment outcome is anemia. Anemia often occurs in TB patients [16]. Hb tends to decrease as the positive acid-fast bacilli (BTA) increases [17]. Based on the study results obtained data, 23 respondents (37.1%) with anemia, nine of whom did not complete the treatment. and there are also 39 respondents (62.9%) of respondents who are not anemic, 33 of whom have completed treatment. The results of statistical tests showed a significant relationship between anemia and the treatment outcomes of pulmonary TB patients (p = 0.035). Previous studies reported that anemia was associated with delayed smear-negative and a higher risk of death [18].

Based on the study results obtained data, 43 respondents (69.4%) had good knowledge about TB, and 19 respondents (30.6%) considered lack knowledge. The results of statistical tests showed a significant relationship between knowledge about TB and the treatment outcomes of pulmonary TB patients (p = 0.014). This study is in line with research conducted in Disomal, which showed a relationship between knowledge about TB and treatment outcomes of pulmonary TB patients [10]. A study showed significant spatial variation in poor TB treatment outcomes in Ethiopia related to underlying socioeconomic status, knowledge of TB, and climatic conditions [19].

The COVID-19 pandemic has significantly impacted transmitting various TB diseases in

prevention, surveillance, and treatment programs. Lockdown and public health guidelines have resulted in severe challenges in the traditional management of TB [20]. Based on the study results, data was obtained that 46 respondents (74.2%) had good knowledge about COVID-19, and 16 respondents (25.8%) who lacked knowledge related to COVID-19. The results of statistical tests showed a significant relationship between knowledge about covid-19 and the results of treatment for pulmonary TB patients (p = 0.014). One study demonstrated considerable disruption in the provision of TB services in both primary care and hospital settings. Lockdown, social distancing, isolation strategies, and public health guidelines to prevent transmission of the virus impact the delivery of all aspects of TB care [20].

Another factor related to the outcome of treatment for pulmonary TB patients during the pandemic is a family history of COVID-19. The COVID-19 pandemic and social-physical distancing significantly impacted TB surveillance and monitoring management of TB patients. In addition, there are concerns about the delay in treatment and can worsen the patient's condition, which can affect MDR TB. [20]. Symptoms of TB and COVID-19 can be similar; for example, cough, fever, shortness of breath, and malaise are common in both. This can lead to confusion in the diagnosis, and also, TB patients experience a fear of COVID-19 continue to increase [21]. Forty-four respondents (87.1%) decided clear of family history of COVID-19. The results of statistical tests showed a significant relationship between a family history of suffering from COVID-19 and the results of treatment for pulmonary TB patients (p = 0.011).

Conclusion

Associated factors to the treatment outcome of pulmonary TB patients during the COVID-19 pandemic included diabetes mellitus status, anemia, knowledge about TB, knowledge of COVID-19, and family history of COVID-19. It is recommended that health workers provide education regarding the flow of services during the COVID-19 pandemic and the importance of carrying out treatment until they are declared cured, even during the COVID-19 pandemic.

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