THE CORRELATION BETWEEN ACID FAST BACILLI SPUTUM EXAMINATION AND CHEST RADIOLOGY IN PULMONARY TUBERCULOSIS PATIENTS AT RUMAH SAKIT UMUM DAERAH DR. H. ABDUL MOELOEK 2021

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Abstract

The Relationship Between Acid Fast Bacilli Sputum Examination And Chest Radiology In Pulmonary Tuberculosis Patients At Rumah Sakit Umum Daerah Dr. H. Abdul Moeloek 2021. Mycobacterium tuberculosis is a bacterium that causes an infectious disease called Tuberculosis (TB). In 2021, Indonesia currently has the third highest number of TB cases in the world. Sputum examination and chest radiology are the main diagnostic tools for diagnosing pulmonary TB. This study aims to determine the relationship between sputum examination and chest radiology in TB patients. The type of this research was analytic observational which was carried out using the cross sectional method using secondary data from the medical records of patients who were confirmed to be infected with pulmonary tuberculosis at RSUD Dr. H. Abdoel Moeloek City of Bandar Lampung in 2020-2022 with a total sample of 136. Data were analyzed using statistical software to see the frequency of data and continued with bivariate analysis using the chi-square method α = 0.05. The results showed AFB+1 with minimal lesions 18 out of 61, AFB +2 with moderate lesions 21 out of 51, and AFB +3 far advanced lesions 17 out of 24. The results of Chi-Square analysis obtained p value = 0.023. There is a relationship between examination of AFB sputum and chest X-ray images in pulmonary TB patients at RSUD Dr. H. Abdul Moeloek Lampung Province in 2020-2022.

Keywords : *Pulmonary TB, Radiology, Chest X-ray, Sputum AFB*

Abstrak

*Hubungan Pemeriksaan Sputum Basil Tahan Asam Dengan Gambaran Foto Toraks Pada Pasien Tuberkulosis Paru Di Rsud Dr. H. Abdul Moeloek Provinsi Lampung**.** Bakteri Mycobacterium tuberculosis merupakan bakteri yang menyebabkan penyakit infeksi yang bernama Tuberkulosis (TB). Pada tahun 2021, Indonesia memiliki jumlah kasus TB tertinggi ketiga di dunia. Pemeriksaan sputum dan radiologi toraks menjadi alat diagnosis utama untuk mendiagnosis TB paru. Penelitian ini bertujuan untuk mengetahui hubungan pemeriksaan sputum BTA dengan gambaran foto toraks pada pasien TB paru. Jenis penelitian ini adalah observasional analitik yang dilakukan dengan metode cross sectional menggunakan data sekunder rekam medis pasien yang terkonfirmasi terinfeksi tuberkulosis paru di RSUD Dr. H. Abdoel Moeloek Kota Bandar Lampung pada tahun 2020-2022 dengan jumlah sampel 136. Data dianalisis dengan perangkat lunak statistik untuk melihat frekuensi data dan dilanjutkan analisis bivariat dengan metode chi-square dengan derajat kepercayaan α = 0,05. Hasil penelitian menunjukkan BTA+1 dengan lesi minimal 18 dari 61, BTA +2 dengan lesi moderate 21 dari 51, dan BTA +3 lesi far advanced 17 dari 24. Hasil analisis Chi-Square didapatkan nilai p=0.023. adanya hubungan antara pemeriksaan sputum BTA dengan gambaran foto toraks pada pasien TB paru di RSUD Dr. H. Abdul Moeloek Provinsi Lampung pada tahun 2020-2022.*

Kata Kunci : *TB Paru, Radiologi, Foto Toraks, Sputum BTA*

INTRODUCION

Mycobacterium tuberculosis is a bacterium that causes an infectious disease called Tuberculosis (TB). These bacteria can not only attack the lungs but can also attack the skin, brain, and even bones. Cough with sputum for 2 weeks or more is the main symptom of TB patients, while additional symptoms include coughing up blood, sputum mixed with blood, sweating at night even when not doing activities, and weight loss (Kemenkes RI, 2018). Many countries have tried to control it using the directly observed treatment short course (DOTS) strategy since 1995. Based on the global tuberculosis report data from the World Health Organization (WHO), there are 9.6 million tuberculosis sufferers in the world. In 2015, Indonesia was one of the five countries with the highest

number of TB cases. Indonesia currently has the second highest number of TB cases in the world after India (Triandini, 2019).

According to the Pedoman Nasional Penanggulangan Tuberkulosis, finding Mycobacterium tuberculosis during microscopic examination of sputum is the main diagnostic tool for confirming the diagnosis of pulmonary TB. The diagnosis of tuberculosis can be made clinically using the results of appropriate clinical examinations and investigations (at least a chest X-ray) and ordered by a trained doctor if the bacteriological examination shows negative results and there is no improvement after administration of non-OAT antibiotics. Chest X-ray is a rapid imaging technique and one of the most important sensitive tools in the diagnosis of pulmonary tuberculosis (Marvellini, 2021). Radiological examination itself is one of the necessary examinations in diagnosing pulmonary TB in patients with negative smears. In addition, it can also be used to assess damage to lung structures caused by TB germs. However, just like AFB examination, radiological examination also has drawbacks. Radiological manifestations in pulmonary TB patients are atypical. Radiological abnormalities in pulmonary TB patients also have similarities with other lung diseases. But not every health facility provides radiology tools so that many pulmonary tuberculosis patients cannot check the extent of lung lesions or have difficulty getting to these facilities (Arfiatny, 2015).

Starting from the information above, AFB sputum examination can determine the number of bacteria and the level of infection as well as a statement from the National Center of HIV/AIDS, Viral Hepatitis, STD and TB Prevention which states that the number of bacteria present in a patient's sputum is directly related to the level of infection. The more bacteria found in the sputum, the more infectious it will be. The author is interested in examining the Correlation between the results of AFB sputum examination and the appearance of chest X-rays in pulmonary TB patients at RSUD Dr. H. Abdul Moeloek at Lampung Province.

METHOD

The research design used in this study was analytic observational which was carried out using the cross-sectional method using secondary data in the form of medical records of patients who were confirmed positively infected with pulmonary tuberculosis at RSUD Dr. H. Abdoel Moeloek City of Bandar Lampung. The target population of this study were the medical records of patients who were confirmed positive for tuberculosis at RSUD Dr. H. Abdul Moeloek Lampung Province. The sample for this study was a sample of medical records taken from a portion of the population that had been examined for AFB sputum and chest X-ray examination at Dr. H. Abdul Moeloek Lampung Province in 2020-2022, which meets the inclusion and exclusion criteria. The sampling technique is Total Sampling.

The inclusion criteria for this study were the medical records of patients who had been clinically diagnosed with primary pulmonary TB at RSUD Dr. H. Abdul Moeloek Lampung Province, medical records of pulmonary TB patients who had radiological examinations in the form of chest photos and photo readings carried out by radiologists, medical records of pulmonary TB patients who underwent smear sputum examination, Examination of AFB sputum is not carried out at least 2 times and medical records of pation for above 12 years. While the exclusion criteria for this study were illegible radiological examination results, patients had a history of co-morbidities such as HIV. The data that has been collected is then processed using computer software. Then the data were analyzed using the SPSS program. Univariate analysis was used to describe the description of the results of

chest x-ray examination and the grade of sputum examination results in patients with pulmonary tuberculosis. Bivariate analysis was used to determine the relationship between each independent variable and the dependent variable using the Chi-Square Test.

RESULT AND DISCUSSION

Based on the samples that have been taken, the distribution of data, or the characteristics of the samples are in table below.

Table 1
Distribution of Sample Data

Characteristics	Frequency (N)	Percentage (%)
Age		
12-25 years old (Adolescent)	14	10,3
26-45 years old (Adult)	62	45,6
46-55 years old (Early Elderly)	44	32,4
56-60 years old (Late Elderly)	16	11,8
Total	136	100
Sex		
Female	37	27,2
Male	99	72,8
Total	136	100
rifampicin resistant		
Rifampicin sensitive	110	80,9
Rifampicin resistance	26	19,1
Total	136	100
AFB		
+1	61	44,9
+2	51	37,5
+3	24	17,6
Total	136	100
Lung Radiology Lesion Size		
Minimal	29	21,3
Moderate	42	30,9
Far Advance	65	47,8
Total	136	100

All samples taken from medical records of Pulmonary Tuberculosis patients have the following data distribution. Based on age, there were at least 14 samples (10.3%) of adolescent patient data and at most 62 samples (45.6%) of adult patient data. Based on gender, there were 99 samples (72.8%) male and 37 samples (27.2%) female. Based on rifampicin resistance, there were 26 samples (19.1%) of patients who were resistant to rifampicin and 110 samples (80.9%) of patients who were sensitive to rifampin. Based on AFB sputum examination, there were 61 samples (44.9%)

+1 AFB and at least 24 samples (17.6%) +3 AFB. Based on the radiological lesion of the lungs, there were at least 29 samples (21.3%) patients with minimal lesion and 65 samples (47.8%) patients with advanced lesion.

The calculation Result based on the AFB sputum examination data and the extent of the chest radiological lesion are obtained in Table 2.

Table 2
Bivariate Analysis of AFB Sputum and Thoracic Radiology Lesion

AFB Sputum	Thoracic Radiology Lesion			Total	p
	Minimal	*Moderate*	*Far Advance*		
+1	18	18	25	61	0,023
+2	7	21	23	51	
+3	4	3	17	24	
Total	29	42	65	136	

Based on the interpretation in the table above, the bivariate analysis used was the chi-square test. The significance level of the p value in the AFB sputum category with the area of the chest radiological lesion was 0.023. Based on this value, it can be stated that there is an corellation between smear sputum examination and the area of chest radiological lesions in pulmonary tuberculosis patients at Dr. H. Abdul Moeloek Year 2020 – 2022.

From the research data presented in table 1, we can see that of the 136 patients diagnosed with pulmonary tuberculosis, the most were in the age range of 26-45 years, namely 62 samples with a percentage of 45.6%. The same results were also found in Dian Wahyu Laily's research where in a study conducted at the Tuminting Manado Health Center in 196 samples, the highest number of pulmonary tuberculosis sufferers was found in the vulnerable ages of 31-40 years (Laily, 2015). In Andayani's research in 2017, it was found that the risk prediction for developing pulmonary TB lies in the productive age and the elderly. In the elderly because those who have decreased immunity along with the aging process, all organ functions have decreased, the ability to fight Mycobacterium tuberculosis is weak so that germs easily enter the elderly body (Andayani, 2017). According to Hutama in his research in 2019. Productive people have a 5-6 times risk of experiencing pulmonary TB, this is because in the productive age group everyone will tend to be highly active, so the possibility of exposure to Mycobacterium tuberculosis is greater, besides that the bacteria will be active again in the body which tends to occur at productive age (Hutama, 2019).

From the research data that has been presented in table 1. We can also see that of the 136 patients diagnosed with pulmonary tuberculosis based on gender, the majority were male, totaling 99 samples (72.8%), while the sex of the female was at most 37 samples (27.2%). This is in line with Fitriyani's research (2013) which was conducted at the Keanggungan Health Center in Brebes Regency, which found that the number of samples of pulmonary tuberculosis in males (41 samples) was higher than females (21 samples) (Fitriani, 2013).

In this study, it can be seen that the most patients diagnosed with pulmonary tuberculosis based on gender is male with total 99 samples (72.8%), while female only 37 samples (27.2%). This

is in line with Fitriyani's research (2013) which was conducted at puskesmas Keanggungan in Brebes Regency, where the highest number of samples of pulmonary tuberculosis was found in males, with 41 samples (Fitriani, 2013). According to Mahendra's research in 2020, this can be caused by the habit of men traveling frequently, so they are more susceptible to exposure to various kinds of bacteria such as Mycobacterium tuberculosis (Mahendrani, 2020).

A Factors that influence the occurrence of pulmonary tuberculosis include socioeconomic conditions, age, gender, nutritional status and smoking habits. Although smoking is not the main cause of pulmonary TB disease, smoking habits can damage the defense mechanisms of the lungs, making it easier for disease germs such as TB germs to enter. In addition, the phenomenon of smoking in Indonesia is still considered normal, even considered as a way of life. Smoking behavior is common for most Indonesian people, especially adult men. The chemical content of tobacco that has been identified amounts to 2,500 components. Of this amount, around 1,100 components were directly reduced to become smoke components and 1,400 others experienced decomposition or split, reacted with other components and formed new components. In the smoke itself there are 4,800 kinds of chemical components that have been identified. The chemical components of cigarettes that are harmful to health have been identified, namely: tar, nicotine, CO and NO gases originating from tobacco (Hapsari et al., 2013). In female respondents who are positive for pulmonary TB, the possibility of exposure to Mycobacterium tuberculosis bacteria is obtained from the surrounding environment which has poor sanitation and hygiene, such as being a passive smoker. As a passive smoker can increase the risk of being infected with the bacteria Mycobacterium tuberculosis. In women, hormonal factors also affect the occurrence of infection where estrogen is protective against pulmonary tuberculosis infection by increasing immune response, cytokine production (namely TNFα, IFNγ) and macrophage activity which facilitates tuberculosis control (Fernandes et al., 2018).

From the research data that has been described in table 1, we can also see from 136 patients diagnosed with pulmonary tuberculosis. Based on rifampicin resistance, there were 110 samples sensitive to rifampicin (80.9%) while there were 26 samples resistant to rifampicin (19.1%). In a study conducted at Cipto Mangunkusumo Hospital in 2012-2015, there were 169 samples sensitive to rifampicin (86.2%) and 27 samples (13.8%) resistant to rifampin, i.e. (5.3%) lower than this study (Nasarudin, 2016). In another study by Rivani (2019) in 2015-2017, 537 samples were found and 167 samples (31%) had higher rifampicin resistance (11.9%) compared to this study (Rivani, 2019). Rifampicin resistance can be a predictor of isoniazid resistance. The European Regional Congress of the Union concluded that rifampicin resistance could be an early marker of multi-drug resistance cases in areas with a high prevalence of TB. Indonesia is an area with a high prevalence of TB. Therefore, the rifampicin resistance rate obtained in this study can be used as a benchmark for the occurrence of multi-drug resistance (Nasarudin, 2016).

From this study it was also found that based on rifampicin resistance, there were 110 samples sensitive to rifampicin (80.9%) while there were 26 samples resistant to rifampicin (19.1%). In another study, 169 samples were sensitive to rifampicin (86.2%) and 27 samples (13.8%) were resistant to rifampicin (Nasarudin, 2016). In Rivani's study (2019), 537 samples were obtained and 167 samples (31%) were resistant to rifampicin (Rivani, 2019). The European Regional Congress of the Union concluded that rifampicin resistance could be an early marker of multi-drug resistance in areas with a high prevalence of TB (Nasarudin, 2016). Drug resistance can be caused by patient disobedient to follow treatment instructions which can actually cause side effects of the TB drug itself. TB sufferers who experiencing effects from treatment are most likely to stop treatment without

notifying health workers, this condition contributes to the occurrence of anti-tuberculosis drug resistance (OAT) (Nugrahaeni, 2015).

Resistance to rifampicin in Mycobacterium tuberculosis is caused by mutations in the rpoB (RNA Polymerase β-Subunit) gene. Quoted from Rachman et al. Rifampicin resistance arises due to mutations in the rpoB gene, especially in the area that is in the middle of the gene and is called the Rifampicin Resistance Determining Region (RRDR). The rpoB gene is a gene that forms the structure of the β-subunit of RNA polymerase which is the target site of the antibiotic rifampicin. The rifampin structure that cannot bind to the β-subunit of RNA polymerase occurs due to inhibition of RNA transcription, which causes protein synthesis to also be inhibited. This inhibition is the reason why rifampicin does not work well or is resistant (Rahman et al., 2022).

In table 1 it was also found in this study in the BTA sputum examination category there were 61 samples in the BTA +1 category (44.9%) more than the BTA +2 (51 samples, namely 37.5%) and BTA +3 (24 samples namely 17.6%). This is in line with Pentecostal research (2013) in 2011-2012 with 34 samples, there were 12 (35.3%) samples with BTA +1 which was higher than BTA +2 (3 samples) and AFB +3 (5 samples). (Pentekosta, 2019). Whereas different results were found in research by Triandini in 2019 where the results of smear examination in the samples were not much different for BTA +1 sputum, namely 23 samples (22.8%), BTA +2, namely 21 samples (20.8%), and BTA +3, namely 23 samples (22.8) (Triandini, 2019).

According to Mulyadi quoted in (Pentecost, 2013) there are several factors that influence the results of AFB sputum examination, such as too few germs due to inadequate sputum collection, inadequate examination methods and methods, and the effect of anti-tuberculosis drug treatment. Difficulty obtaining sputum, especially if the patient coughs infrequently or has a non-productive cough. (Pentekosta, 2013).According to Mulyadi quoted in (Pentekosta, 2013) there are several factors that affect the results of AFB sputum examination, such as too few germs due to inadequate sputum collection, inadequate examination methods and methods, and the effect of anti-tuberculosis drug treatment (Pentekosta, 2013) . This is also supported by the statement of Arfiatny in 2015 that there are things that also affect the results of AFB sputum examination such as sputum that does not meet the requirements because the patient has difficulty release sputum, in addition to the lack of laboratory staff skills, microscope tools that have not been calibrated, or inadequate preparation of preparations. good, and too few bacteria (Arfianty et al., 2015). AFB bacteria are sometimes difficult to find, new bacteria can be found if the bronchi involved in TB disease are open to the outside, so that sputum containing AFB bacteria is easy to obtain (Amin, 2014). In theory, people infected with Mycobacterium tuberculosis will cause a complex cellular immune response that forms a pneumonic lesion, the lesion will become a cheese-like tissue which will soften or melt, so that when coughing it will produce sputum containing smears and leave lesions on the picture. radiology (Arfiatny, 2015).

Radiological examination itself is one of the necessary examinations in diagnosing pulmonary TB in patients with negative smears. In addition, it can also be used to assess damage to lung structures caused by TB germs. However, just like AFB examination, radiological examination also has drawbacks. Radiological manifestations in pulmonary TB patients are atypical. Radiological abnormalities in pulmonary TB patients also have similarities with other lung diseases. From the research data presented in table 1, we can see that of the 136 patients affected by pulmonary TB, based on the lesion area, the most common were far advanced lesions, namely 65 samples (47.8%)

followed by Moderate lesion areas, namely 42 samples. (30.9%) and finally the minimal lesion area, namely 29 samples (21.3%).

Mycobacterium tuberculosis bacteria that enter through the airways will nest in the lung tissue and will form a pneumonic nest called a primary nest. Pulmonary tuberculosis begins with early nests which are usually found in the apical and posterior segments of the upper lobe because the oxygen pressure in that area is higher (compared to the zone at the bottom) causing more Mycobacterium tuberculosis to grow (Kasper et al., 2015). People infected with Mycobacterium tuberculosis will cause a complex cellular immune response that forms a pneumonic lesion, the lesion will become cheese-like tissue which will soften or melt, so that when coughing it will produce sputum containing smears and leave lesions on radiological images. So it can be concluded that the wider the lesion on chest radiology examination, the more bacteria can be found on AFB sputum examination. Due to the increasing number of bacteria that gather in the lungs, the Mycobacterium tuberculosis bacteria will multiply more quickly and result in an increase in the number of AFB which can be seen on AFB sputum examination. Based on the bivariate analysis table, the increasing positivity of BTA examination results increases the number of patients with larger lesion image (Amin, 2014).

As explained above, bacteria that enter the lungs will also cause a complex cellular immune response that forms a pneumonic lesion, the lesion will become cheese-like tissue which will soften or melt, so that when coughing it will produce sputum containing AFB. and leave lesions on radiological images. According to Arfiatny et al. (2015) there are several other factors that may influence the two examination results resulting in wrong interpretation of radiological results such as tool quality, photo quality, and knowledge of chest photo readings (Arfiatny, 2015). Calculation of bivariate analysis in table 2 shows the percentage in each category. In the sample with BTA +1 sputum examination results, there were 18 samples (13.2%) in the minimal lesion area category with an expected frequency of 13.0, 18 samples (13.2%) in the moderate lesion area category with an expected frequency of 18.0, and 25 samples (18.4) in the broad category of far advanced lesions with an expected frequency of 29.2. In the BTA +2 sputum examination category there were 7 samples (5.1%) in the minimal lesion area category with an expected frequency of 10.9, 21 samples (15.4%) in the moderate lesion area category with an expected frequency of 15.8, and 23 samples (16.9%) in the broad category of far advanced lesions with an expected frequency of 24.4.

Examination of AFB sputum smear is the main diagnostic investigation in developing countries because it is the most efficient, easy, and fast. The results of a positive BTA sputum examination were determined by several factors including patients who were not compliant with treatment and patients who did not take treatment according to the specified time because they felt recovered after taking the drug for several weeks (Subekti, 2016). there are things that also affect the results of AFB sputum examination such as sputum that does not meet the requirements because the patient has difficulty removing sputum or only saliva, in addition to the lack of ability of laboratory workers, microscope tools that have not been calibrated, or poor preparation, and too least bacteria. The results of radiological examinations using chest X-rays mostly show extensive pictures of lung lesions with far advanced lesions. This is the same as a study conducted by Sembiring that the most commonly found lesions were far advanced as much as 44.1% of the total sample (Sembiring, 2018). However, it is different from the study by Husein and Majdawati in 2014 that the results of chest photo readings in 51 clinical samples of non-DM pulmonary TB patients were the most with minimal lesions, namely 17 samples or 53.1% of the total sample (Husain and Majdawati, 2014).

The results of smear smear +1 sputum examination, the most common lesion area is the far advanced lesion area. This may be due to a poor nutritional status. Poor nutritional status can affect the body's response in the formation of antibodies and lymphocytes to the presence of disease germs. This formation requires protein and carbohydrate raw materials, so that in people with malnutrition the production of antibodies and lymphocytes is inhibited. Poor nutritional status will affect immunity and will reduce the body's resistance so that it is susceptible to infection which in turn becomes TB. The more a person's body mass index decreases, the more extensive the pulmonary TB lesions are on his chest X-ray. On the other hand, the higher a person's body mass index, the less pulmonary TB lesions on his chest X-ray (Edwina et al., 2016). The National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention states that the amount of bacteria present in a patient's sputum is directly related to the level of infection. The more bacteria found in the sputum, the more infectious it will be.

CONCLUSSION AND SUGGESTION

Based on the analysis of the results of the research that has been done, it can be seen that there is a relationship between the results of AFB sputum examination and the appearance of chest X-rays in pulmonary TB patients at RSUD Dr. H. Abdul Moeloek Lampung Province in 2020-2022.

Hoped that the results of this study can also be used as a reference regarding the need for further research regarding the relationship between the extent of thoracic radiological lesions and the results of AFB sputum examination in adult case pulmonary TB patients with a larger number of samples so that more significant results can be obtained. And it is also recommended to conduct further research by adding research variables that can compare the extent of tuberculosis lesions with comorbidities.

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