Original Research

PROFILE OF TUBERCULOSIS IN CHILDREN IN TAMAN DISTRICT, SIDOARJO REGENCY, INDONESIA

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ABSTRACT

The prevalence of tuberculosis (TB) in Indonesia was 391 per 100,000 population with 110,000 of deaths in 2016. This study was a descriptive study research aimed to determine the profile of pediatric TB patients using medical records at Taman public health center, Sidoarjo, Indonesia, in the period of 2016-2019. The samples in this study were 31 pediatric patients aged 0-14 years with a history of TB obtained by total sampling technique.There were 31 patients consisted of those aged >5 years (58.1%) and ≤5 years (41.9%), 83.9% of those had pulmonary tuberculosis (83.9%), and 16.1% with extrapulmonary tuberculosis. The patients aged ≤5 years had good nutritional status (32%) and those who had poor nutritional status were 27.2%. Meanwhile, those aged >5 years had poor nutritional status (22.7%) and those who had good nutritional status were 18.1%. The patients who had a history of contact with adult TB patients were 86.7% and those who did not have a history of contact with adult TB patients were 13.3%, while those who had received BCG immunization were 86.2%, and 13.8% had not received BCG immunization. This study concluded that most pediatric TB patients were >5 years old, and almost all pediatric TB patients had pulmonary tuberculosis. Pediatric TB patients aged ≤5 years were more likely to have good nutrition. Meanwhile, there were more pediatric TB patients aged >5 years who had poor nutritional status. Almost all pediatric TB patients had a history of contact with adult TB patients and had received BCG immunization.

Keywords: *Tuberculosis; tuberculosis in children; tuberculosis profile; pediatric*

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Highlights:

1. Pediatric tuberculosis patients profile using the medical records was determined.
2. The most pediatric tuberculosis patients under five years have pulmonary tuberculosis.
3. Pediatric tuberculosis patients received BCG immunization had a contact with adult tuberculosis patients histories.

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by *bacterium Mycobacterium* tuberculosis and currently still becomes health problem throughout the world. In 2016, there were more than 10.4 million cases of tuberculosis with more than 1.3 million people died from tuberculosis. Tuberculosis is a great problem for public health in developing countries, one of which is Indonesia. In 2016, Indonesia was ranked second in the world with around 1,020,000 cases of tuberculosis, while 60,000 cases occurred in children aged 0-14 years.

The transmission of tuberculosis in children still happens. It becomes a concern and success indicator in TB control in the community (Winston & Menzies 2012). Taman public health center has many cases of tuberculosis based on Sidoarjo Regency health profile data report. In 2014, in the working area of the Taman public health centers, there were 61 new AFB-positive cases with a total of 121 TB cases (Sidoarjo Health Office 2015). According to data in 2014, 54 cases of TB in children were reported in several public health centers in Sidoarjo. Taman public health center had the highest number of TB cases for children compared to other health center with only 15 cases (Sidoarjo Health Office 2015). Children who are exposed to *bacterium Mycobacterium* tuberculosis will be at risk of developing tuberculosis infection.

The nutritional status of children is very influential on body's immunity. Children who are malnourished will result in a decreased immune system, so that they are susceptible to tuberculosis infection (Febrian 2015). On the other hand, infectious diseases with any severity can be detrimental to any nutritional state (Fatimah et al. 2010). The infection that occurs is also influenced by several factors, including intensity and contact with adult tuberculosis patients, as well as the body's immune response (Seddon et al. 2013). Giving BCG immunization can provide immune protection in infants against TB disease. Tuberculosis in children can cause developmental disorders, even death. This study aimed to determine the profile of tuberculosis in children at the Taman public health center as an initial stage in diagnosing variety of symptoms of tuberculosis in children.

MATERIALS AND METHODS

This study used descriptive method to find the elements, characteristics, properties of a phenomenon. Starting with the data collection process, analyzing the data, and interpret (Suryana 2010). The procedure used in this study was documentation study. The instrument used in this study was medical record data for pediatric TB patients for 2016-2019 period at Taman public health center. 31 pediatric patients aged 0-14 years with history of pulmonary and extrapulmonary TB treated at the Taman public health center were the samples in this study. This study used a total sampling technique by taking into account the existing inclusion criteria. The inclusion criteria in this study were children aged 0-14 years who suffered or had a history of pulmonary or extrapulmonary TB and lived in Taman district, Sidoarjo regency.

The variables were age, type of tuberculosis, nutritional status, history of contact with adult TB patients, and BCG immunization status. Assessment of nutritional status for children aged ≤5 years was calculated using weight-for-age parameter, then interpreted based on the anthropometric standard of the child according to the Z-score of the WHO Child Growth Standards. Meanwhile, the assessment of nutritional status for children aged >5 years was calculated using BMI-for-age parameters, then interpreted based on CDC Growth Charts 2000. The data were calculated using univariate analysis in the form of percentages and presented in Table.

RESULTS

The identification of the characteristics of pediatric TB patients aged 0-14 years in the working area of Taman public health center is shown in the Table 1.

The total of data obtained from medical record data for pediatric TB patients in the period 2016-2019 were 31 data. Table 1 and Table 2 describe the characteristics of pediatric tuberculosis patients. The table explained that most of the subjects were male (51.6%). Most of the pediatric TB patients were children older than 5 years (58.1%). Almost all patients suffered from pulmonary tuberculosis (83.9%). Almost all pediatric tuberculosis patients had a history of contact with adult TB patients (86.7%). From the results of the study, almost all pediatric TB patients had received BCG immunization (86.2%).

The assessment of nutritional status for children aged ≤5 years old was calculated using the weight-for-age parameter and interpreted based on Child Anthropometric Standards according to the WHO Child Growth Standards Z-score. The assessment of nutritional status for children aged >5 years was calculated using BMI-for-age parameters, and interpreted based on 2000 CDC Growth Charts. From Table 2, most patients under 5 years old had normal nutritional status (32%). Meanwhile, most of the patients aged over 5 years old had poor nutritional status (22.7%).

Table 1. Distribution and frequency of TB in children by gender, age, classification of TB, history of contact with adult TB patients, BCG immunization status

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	16	51.6
Female	15	48.4
Age		
≤5 years old	13	41.9
>5 years old	18	58.1
TB Classification		
Pulmonary Tuberculosis	26	83.9
Extrapulmonary Tuberculosis	5	16.1
History of contact with adult TB patient	30	96.8
Known	26	86.7
There is contact history	4	13.3
There is not contact history	1	3.2
Unknown		
BCG Immunization Status		
Known	29	93.5
Immunized	25	86.2
Not yet immunized	4	13.8
Unknown	2	6.5

Table 2. Distribution and frequency of TB in children by nutritional status

Characteristics	Nutritional Status							
Known	Frequency (n)					Percentage (%)		
	22					71		
≤5 years old (Weight-for-Age)	Very low weight		Less weight		Normal		Risk of overweight	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
	3	13,6	3	13,6	7	32,0	0	0,0
>5 years old (BMI-for-Age)	Less weight		Normal		Overweight		Obesity	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
	5	22,7	3	13,6	1	4,5	0	0,0
Unknown	Frequency (n)					Percentage (%)		
	9					29		

DISCUSSION

According to World Health Organization (2017a), males have a higher risk of being infected and dying of tuberculosis than females. There are more than five hundred thousand boys aged 0-14 years in the world infected with tuberculosis (WHO 2017a). In Indonesia, the incidence of tuberculosis in male aged 0-14 years is reported to be more than thirty thousand cases (WHO 2017b).

The results of this study stated that most of the pediatric TB patients in Taman public health center working area were male (51.6%). Another study conducted in Yogyakarta also showed that the number of cases of pulmonary TB in males was more than females, namely 57.6% in the case group (Upe 2015). Meanwhile, another study conducted in the United States showed that pediatric TB patients were more common in females (54%) than males (46%) (Pang et al. 2014). This is in line with the research conducted by Simbolon, which showed that there was no difference in risk of pulmonary TB by gender (Simbolon 2007).

In this study, children aged >5 years old had a higher percentage than 5 years old. The distribution of pediatric tuberculosis cases by age in Taman public health center was 58.1% with age ranging from 5-14 years old. Contrary, a study had found that pediatric tuberculosis was more common in children <5 years old (Marais & Schaaf 2014). Children who are exposed to bacterium Mycobacterium tuberculosis will be risky of developing tuberculosis infection. Children aged ≤5 years are vulnerable group to health and nutrition problems. Of course, this is related to the development of immature immune system (Oktaviani 2011).

However, a study indicated that at any age, our body can fight infection only if the nutritional status is adequate (Apriliasari et al. 2018). Similarly, a study also indicated that the distribution of tuberculosis cases

in children aged 5-14 years was 62.5% (Nurwitasari & Wahyuni 2015). Another study conducted in Aceh also showed that the majority of pulmonary TB patients belonged to the productive age group (70%) (Hadifah et al. 2017). This happened, because he had been infected with bacterium Mycobacterium Tuberculosis for a long time, but it did not immediately become a disease. Bacteria will form colonies whose growth is limited by cellular immunity. These bacteria will still live in dormant form. When the condition of immune system decreases, bacteria will be active again and develop into TB disease (Werdhani 2002).

In this study, almost all pediatric TB patients had pulmonary TB (83.9%). The results of a study conducted in the United States showed that the incidence of pulmonary TB was more than extrapulmonary TB (Winston & Menzies 2012). Other studies that supported the results of this study also showed that pulmonary TB disease (68%) was more common than extrapulmonary TB (32%) (Pang et al. 2014). Meanwhile, the incidence of pulmonary TB in Spain was 126 cases out of a total of 134 patients (Soriano-Arandes et al. 2019).

Pulmonary tuberculosis is the most common clinical manifestation compared to extrapulmonary tuberculosis. This happens, because the lungs are the entry point for TB bacteria in more than 98% of TB infections. Due to its small size, it is easier for TB bacteria in infectious droplets to inhale and enter the alveoli (Werdhani 2002). In addition, the nature of TB bacteria that have an affinity for oxygen makes the lungs as a favorite organ for TB bacteria (Zombini et al. 2013).

In this study, the data obtained from the medical records of pediatric TB patients in the Tuberculosis Polyclinic at Taman public health center were incomplete, so that there were some data on pediatric TB patients whose nutritional status could not be calculated. The total number of data that could be calculated for nutritional status were 22 children, while those which could not be calculated were 9 children. From the total amount of data for nutritional status, 13 children were ≤5 years old and 9 other children were >5 years old. Nutritional status was calculated from weight-for-age for children aged ≤5 and calculated from BMI-for-age for children aged >5. There were more pediatric TB patients aged ≤5 who had normal/ good nutritional status (32%) than those with poor nutritional status (27.2%). Meanwhile, pediatric TB patients aged >5 had more poor nutritional status (22.7%) than those who had normal/ good nutritional status (18.1%).

It was found that the number of pediatric TB patients is more prevalent in children aged >5 years, because in this age group, more children had poor nutritional status than normal/ good nutritional status. This is in line with the results of other studies conducted in the region Garuda public health center Bandung city in 2013 showed the number of respondents with poor nutritional status was 13 children (59.1%) of the total number of respondents (Febrian 2015). Another study also showed that 57.5% of the case group were children with poor nutritional status (Yustikarini & Sidhartani 2015). The results of another study conducted in Jember showed the number of children in the case group with poor nutritional status was 79.2% (Nurwitasari & Wahyuni 2015).

Nutritional status is a condition caused by a balance between intake and nutritional needs needed for various biological processes of the body (Fuadiyah 2009). An imbalance between intake and the nutritional needs of the body can reduce nutritional status (Oktaviani 2011). Poor nutritional status will increase the risk of TB disease. Likewise, the disease course of TB that affects immune system will also lead to poor nutritional status (Nandariesta et al. 2019). When a child has an active disease, the inflammatory response generated will increase the rate of metabolism and cause anabolic blocks that affect absorption, distribution, and excretion of nutrients in the body, which will lead to malnutrition. Malnutrition is often associated with an increased risk of respiratory tract infections (Jaganath & Mupere 2012).

Based on the results of this study conducted at the Tuberculosis Polyclinic at Taman public health center, from 30 data with known contact history, almost all pediatric TB patients had a history of contact with adult TB patients, which amounted to 26 children (86.7%), while 4 other children (13.3%) had no history of contact with adult TB patients. Another study showed 28 respondents (70%) from the case group had a history of contact with smear-positive adult TB patients (Yustikarini & Sidhartani 2015). Another study that supported the results of this study was a study conducted in the United States, that as many as 79 pediatric TB patients (53%) had a source of transmission and 51 sources of transmission of which (65%) were close household contacts (Pang et al. 2014).

Contact history is an important indicator of scoring system used in the TB diagnosis process in children. Family is the closest contact with pulmonary TB patients. If the number of family members is large enough, the risk of transmission to vulnerable groups (toddlers) will also increase (Hadifah et al. 2017). The source of transmission of TB infection in children comes from the closest family members, which are parents or caregivers who live together for a long time (Nurwitasari & Wahyuni 2015). Children are very easy

to catch tuberculosis bacteria from adults. Adult TB patients can spread bacteria in the form of tiny infectious droplets that come out when talking, coughing, or sneezing. Infectious droplets that survive in the air can be inhaled by people around, including children (Nandariesta et al. 2019).

Children who have a history of contact with adult pulmonary TB patients have a 3.1 times greater risk of being infected with pulmonary TB compared to children who do not have a history of contact with adult pulmonary TB patients (Apriliasari et al. 2018). Sources of TB disease transmission are pulmonary TB patients with positive smear and TB transmission to children depends on the level of transmission, duration of exposure, and the child's immune system. TB patients with negative smear results can still transmit TB disease. In the 2014 National Guideline for Tuberculosis Control, it is stated that the transmission rate of positive smear TB patients is 65%, negative smear TB patients with positive culture results are 26%, while TB patients with negative culture results and positive chest X-ray are 17% (Ministry of Health 2014).

In this study, there were a total of 29 pediatric TB patients whose BCG immunization status was known from the patient's medical record data. It was found that more children had received BCG immunization than children who had not received BCG immunization, as many as 25 respondents (86.2%) had received BCG immunization, while 4 respondents (13.8%) had not received BCG immunization. In another study, 32 respondents (80%) in the case group had received BCG immunization, so that there was no relationship between BCG immunization status and TB disease in children (Yustikarini & Sidhartani 2015). Other studies that support this study also show that most pediatric TB patients have received BCG immunization, namely 66.7% in the case group and 91.7% in the control group (Afifah 2019).

In this study, almost all respondents who had received BCG immunization were still exposed to tuberculosis. This might be due to other factors that could affect the effectiveness of the BCG vaccine given (Febrian 2015). To fight TB bacteria, it is necessary to have good cooperation from the complex immune response (innate and adaptive immunity) in the body. In newborns who still do not have a perfect immune system, only rely on the response of the innate immune system and maternal antibodies in case of infection (Jaganath & Mupere 2012). The provision of BCG immunization can increase the coverage of exclusive breastfeeding against TB infection, because it can improve the child's immune system. Giving BCG immunization can affect the incidence of TB in children, because if they have not received BCG immunization in children at infancy, the child's immune system will be disturbed, so that they are susceptible to TB disease (Afifah 2019).

In several published studies, the effectiveness of BCG immunization ranges from 0% to 80%. This could be due to the differences in the type of BCG used, the differences in TB bacteria strains in different regions, differences in levels of exposure and immunity to environmental mycobacteria, and differences in immunization practices (Upe 2015). BCG vaccine cannot guarantee full protection against possible TB infection, about 68.6% who have been immunized with BCG are infected with TB. Although the immunity that is formed does not guarantee that a person is not infected with TB bacteria, BCG immunization can protect against more severe types of tuberculosis, such as miliary TB and meningitis in children, so that if a person has a TB infection, it is not progressive and does not cause severe complications (Yustikarini & Sidhartani 2015).

Strength and limitation

This study provides valuable information about the profile of pediatric TB patients in a specific location in Indonesia, including their age, nutritional status, type of TB, history of contact with adult TB patients, and BCG immunization status. The use of medical records as a data source allowed for a relatively large sample size and the use of a total sampling technique increased the representativeness of the sample. The study was conducted at a single public health center in Indonesia, so the findings may not be generalizable to other locations or populations.

CONCLUSION

Most pediatric TB patients were >5 years old, and almost all pediatric TB patients had pulmonary tuberculosis. Pediatric TB patients aged ≤5 years were more likely to have good nutrition. Meanwhile, there were more pediatric TB patients aged >5 years who had poor nutritional status. Almost all pediatric TB patients had a history of contact with adult TB patients and had received BCG immunization.

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Conflict of interest

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Author contribution

RDO, PL, and DM contributed analysis data and conseptual study. RDO was write and revised the manuscript. RAS was final check.

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