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Risk Factors of Tuberculosis Transmission in Children in Fakfak Hospital, West Papua

Dian Rizky Amelia*, Lasmauli Situmorang

Department of Pediatrics, Fakfak hospital, West Papua, Indonesia
E-mail: ameliadianrizky@gmail.com; lasma2ys@gmail.com

*Corresponding author details: Dian Rizky Amelia, ameliadianrizky@gmail.com

ABSTRACT

Introduction: The emergence of the Coronavirus disease (Covid-19) pandemic caused tough efforts to control tuberculosis. So the focus of health programs has been shifting the world with the Covid -19 pandemic. These risks increase the number of cases and transmission of tuberculosis. Children are one of the groups that are tend to be suffer from tuberculosis because of their low immunity.Fakfak hospital as a referral health care facility in West Papua has several problems with pediatric tuberculosis cases while primary health care has limited facilities to diagnose tuberculosis in children so there are frequently over-underdiagnosed or unreported cases. **Objective:** To investigate the risk factors of Tuberculosis Transmission in Children in Fakfak hospital. **Methods:** This cross-sectional analytic observational study in Fakfak hospital from January 2019 to December 2021. From medical records, samples (N=214) were obtained with purposive sampling that complied with inclusion and exclusion criteria. The analyzed risk factors consist of age, nutritional status, Bacille Calmette Guerin (BCG) vaccination, contact history with adult tuberculosis patients, and maternal education. Data were analyzed with chi-square test and logistic regression method by SPSS statistic application. The results are significant if $p<0.05$. **Results:** There were significant results in nutritional status p=0.000 ($p<0.05$) (PR 4.95, CI95% 2.30-10.66), BCG vaccination p=0.007 ($p<0.05$) (PR 3.31, CI95% 1.39-7.89), close contact with tuberculosis patient p=0.000 ($p=<0.05$) (PR 19.44, CI95% 7.98-47.39), and maternal education p=0.003 ($p<0.05$) (PR 3.11, CI95% 1.49-6.52). The regression test showed significant results on these four risk factors. **Conclusion:** Nutritional status, close contact with tuberculosis patients, and maternal education were significant risk factors for the prevalence of pediatric tuberculosis in Fakfak hospital.

Keywords: tuberculosis; risk factor; pediatric

INTRODUCTION

Tuberculosis prevalence has risen in Indonesia and makes it to be the second-highest case after India. The case amount was 845,000 with a mortality number of 98,000. It is equal to 11 deaths per hour.[1] Because of the pandemic, the government prioritizes is not optimal in implementing tuberculosis management. These reductions in case notifications could lead to a dramatic increase tuberculosis cases and make it more infected especially the children group.[2,3] Pediatric tuberculosis prevalence in West Papua in 2019 was 1,856 cases (65%) infected by adult patients. Tuberculosis prevalence in Fakfak was 23.86% (the fifth highest in the Papua region after Manokwari, Sorong, Bintuni, and South Sorong). Tuberculosis treatment success rate in 2019 was 64%, yet the government target was more than 90%.[4] In Fakfak hospital, there was 60 cases tuberculosis in 2019, 24 cases in 2020, and 23 cases in 2021. It was difficult to diagnose tuberculosis in primary health care because of the limited facility. There is no thorax x. ray and mantoux test which affects over-or-underdiagnosed and unreported tuberculosis cases.[8] It is difficult to find new cases of pediatric tuberculosis so the treatment and the project will be ineffective. The severity of the disease depends on some factors, they were maternal education, nutritional status, age, BCG vaccination, and close contact with tuberculosis patients.[9] Close contact and poor nutritional status are the main factors of tuberculosis transmission.

BCG vaccination before primary infection gives 40-70% security for 10-15 years old children. This vaccine also minimizes other tuberculosis formed by 80%.[10] World Health Organization (WHO) stated that the Covid-19 pandemic has affected the low of BCG vaccination receivers.[11] Based on this problem, this study will analyze the risk factors of pediatric tuberculosis at Fakfak hospital, West Papua in 2019-2021.

METHODS

This study is a cross-sectional analytic observational study with purposive sampling from medical record data of Fakfak hospital from January 2019 till December 2021.

Samples were children diagnosed with tuberculosis and without tuberculosis that include in the inclusion and exclusion criteria. The diagnosis of tuberculosis was decided based on clinical manifestation and scoring of tuberculosis symptoms. Independent variables are age, nutritional status, BCG vaccination, close contact with tuberculosis patients, and maternal education. The dependent variable is pediatric tuberculosis prevalence. Data were analyzed by SPSS with a chi-square test and logistic regression. The results were significant if $p<0.005$.

RESULTS

Establishing inclusion and exclusion criteria for this study were 214 patients (n=107 diagnosed with tuberculosis, n=107 not diagnosed with tuberculosis).

Characteristics of that samples (shown in table 1.) were analyzed using chi-square and logistic regression methods (shown in table 2.). Four of five variables have a significant risk of pediatric tuberculosis in bivariate analysis, they were age (*p=0.004*), nutritional status (*p=0.000*), close contact (*p=0.000*), and maternal education (*p=0.001*).

Logistic analysis regression is used to obtain in four variables with significant results. They were nutritional status (PR 4.956; 95%CI 2.30 – 10.66; *p=0,000*), BCG vaccination (PR 3.318; 95%CI 1.39 – 7.89; *p=0.007*), close contact (PR 19.448; 95%CI 7.98 – 47.39; *p=0.000*), and maternal education (PR 3.11; CI95% 1,49-6,52; *p*=0.003) (showed in table 3.).

TABLE 1: Samples characteristics

Variable	Characteristic	Frequency	Total (%)
Tuberculosis	Tuberculosis	107 (50%)	214 (100%)
	No Tuberculosis	107 (50%)	
Age	<5 years old	113 (52.8%)	214 (100%)
	≥ 5 years old	101 (47.2%)	
sex	Male	114 (53.3%)	214 (100%)
	Female	100 (46.7%)	
Nutritional status	Good	109 (51%)	214 (100%)
	Poor	105 (49%)	
BCG Vaccination	Vaccinated	77 (36%)	214 (100%)
	Not Vaccinated	137 (64%)	
Close contact with tuberculosis patients	Yes	87 (40.6%)	214 (100%)
	No	127 (59.3%)	
Maternal education	High	87 (40.6%)	214 (100%)
	Low	127 (59.3%)	

TABLE 2: Bivariate analysis of tuberculosis risk factors in children

Variable	Criteria	Prevalence of Tuberculosis		Total	PR	CI 95%	p
		Without Tuberculosis	Tuberculosis				
Age	<5 years old	46 (40.7%)	67 (59.3%)	113 (100%)	2.221	1.28 – 3.84	0.004
	≥5 years old	61 (60.4%)	40 (39.6%)	101 (100%)			
Nutritional Status	Good	74 (67.9%)	35 (32.1%)	109 (100%)	4.613	2.59 – 8.20	0.000
	Poor	33 (31.4%)	72 (68.6%)	105 (100%)			
BCG Vaccination	Vaccinated	44 (57.1%)	33 (42.9%)	77 (100%)	1.566	.89 – 2.74	0.117
	Not Vaccinated	63 (46.0%)	74 (54.0%)	137 (100%)			
Close contact	yes	17 (19.5%)	70 (80.5%)	87 (100%)	10.016	5.20 – 19.25	0.000
	no	90 (70.9%)	37 (29.1%)	127 (100%)			
Maternal education	High	56 (64.6%)	31 (35.6%)	87 (100%)	2.692	1.53 – 4.73	0.001
	Low	51 (40.2%)	76 (59.8%)	127 (100%)			

TABLE 3: Multivariate analysis of tuberculosis risk factors in children

Risk factors	PR	CI 95%	P
Age (< 5 years)	1.665	.799 – 3.46	0.173
Nutritional status (poor status)	4.956	2.30 – 10.66	0.000
BCG Vaccination (No vaccinated)	3.318	1.39 – 7.89	0.007
Close contact (yes)	19.448	7.98 – 47.39	0.000
Maternal education (low)	3.118	1.49 – 6.52	0,003

DISCUSSION

A multivariate analysis study said that age is not significant to be a risk factor for pediatric tuberculosis (p=0.449). This study similar with another study that showed age and tuberculosis prevalence in children is not significant (p=0.387).[12] Another study also said that age is not significant to infection. A study from Simbolon said that there were no significant risk factors for tuberculosis prevalence in children based on age.[13] An individual at any age will be against infection if supported with good nutrition. A child with malnutrition has low immunity, and easy to get the infection.[14]

This study it was obtained that children without BCG vaccination were three times more likely infected with tuberculosis than children who have BCG vaccination (PR 3.318; 95%; CI 1.39-7.89; p= 0.007). It is similar with a study by Son et al, 2018 showed that on-time BCG vaccination will get optimal antibodies to prevent Mycobacterium growth.[15] BCG Vaccination schedule of IDAI (Indonesian Pediatric Association) said that the vaccine should be given before 3 months old, and the Health Department of Republic Indonesia said that the vaccine should be given between 0-12 months old. If the vaccination is given at 3 months old, they should get a tuberculin test to know if they were got infected or not. If there were neonates who have close contact with tuberculosis patients, they should get BCG vaccination before 7 days old.[16] The effectiveness of BCG vaccination is 0-80%. This means that those who are vaccinated are not completely free from tuberculosis infection but will not get more complications such as meningitis or milliary tuberculosis. Several factors that affected the effectiveness of BCG vaccination are the timing of BCG vaccination, the difference between BCG vaccines, the bacterial exposure, genetic, nutritional status, and the quality of the vaccine.[17] Nutritional status is important in tuberculosis prevention in children. Poor nutrition will decrease immunity.[18] This study showed that there was a significant effect of poor nutritional status on tuberculosis prevalence in children (p=0.000; PR 5.7). Another study showed that malnutrition children have a risk to get tuberculosis infection 3.31 times higher than healthy children.[19] Malnutrition lead to antibody and lymphocyte decrease because of the lack of carbohydrate and protein.[20] Tuberculosis and nutrition have a difficult to determine. Malnutrition will increase the pathogenesis cycle that leads to primer infection in a short period, then will increase the disease reactivation in a long period.[21,22]

In this study, close contact is the significant risk factor for tuberculosis prevalence in children. It was similar with the sharma et al 2018 studies, which showed that children who live under the same roof as adult patients with tuberculosis have likely 13.7 times higher to getting infected.[23] The number of bacteria and the transmission from a droplet in the air are the reason for it. Children are very susceptible to infection through the people around them.

Children are more often infected than people with comorbidities that are not recognized as a result of decreased immunity due to incomplete treatment. Children living with sputum smear positive adult TB patients within 3 months before starting therapy are vulnerable to acquired tubercular infection.[8] The chance of increasing exposure to tuberculosis is closely related to the number of infectious cases in the community and the intensity of coughing from the source of transmission. The more sources of adult tuberculosis transmission, the higher percentage of acid-fast bacillus (AFB) sputum in tuberculosis patients, the higher percentage of tuberculosis infection in children automatically. Adult sufferers spread germs into the air in the form of droplets when talking, coughing, or sneezing. Droplets containing germs can survive in the air at room temperature for several hours, and can be inhaled by people around, including children.[24] Children infected with tuberculosis germs are mostly infected by family members, caregivers, or neighbors. This case is very infectious because the more frequent and longer interactions with contacts, the greater the transmission of TB to children.[25]

Low maternal education is one of the risk factors that are significant with tuberculosis prevalence in children. Ernirita et al, 2020 studies showed that a mother with low education has a 6.31 times higher for having children with tuberculosis than the high education one (PR 6.31; 95% CI=1.52– 12.94; p=0.004).[26] Another study said that low maternal education is related to tuberculosis children infection (PR=3.579; 95% CI = 1.437 – 8.913).[12] In general, the level of formal education tends to be positively related to the level of knowledge. In addition, education can also affect someone's behaviour and lifestyle. Higher parental education will make preventive actions, have a better health status, and know more about health problems. Education is very influential in efforts to improve children's health that mothers will be more responsive to children's health. Parents with higher levels of education also pass on health outcomes children.[27]

Tuberculosis socialization in children is very necessary to provide education to the community and especially health workers who are far from adequate health facilities. Initial screening at primary health care is very necessary to reduce all risk factors that cause tuberculosis in children and the cases can be detected early. Cooperation between teams, tuberculosis program holders, health volunteers, local health services, health centers and pediatricians in the area will certainly be able to help reduce the prevalence of tuberculosis in children and minimize all risk factors that increase tuberculosis and its transmission in various aspects.

The limitation of this study is the use of secondary data so it depends on the completeness of the data. Recall bias was obtained from the research subjects due to differences in the patient's ability to remember the basic data asked during the anamnesis when the patient was hospitalized.

In addition, the patient's Human Immunodeficiency Virus (HIV) status was also not analyzed because the lack of data, as well as the severity of the symptoms, and the close contact with tuberculosis patients were not explained in detail. For further research, it is recommended to conduct a prospective study with primary data and use additional variables, such as the severity of clinical symptoms that may have a relationship with the severity of tuberculosis, and to conduct more specific interviews with patients and families to obtain more accurate information.

CONCLUSION

In this study, the significant risk factors of pediatric tuberculosis are nutritional status, BCG vaccination, close contact, and maternal education. Additional studies should be added to know the risk factors of pediatric tuberculosis.

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