

Characteristics and Risk Factors in Pediatric Tuberculosis Patients at Pasirian Hospital, Lumajang, East Java

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ABSTRACT

Background: Tuberculosis is a disease caused by *Mycobacterium tuberculosis*. Malnutrition is also a significant risk factor in developing pediatric tuberculosis. Indonesia is one of the top four high-burden countries for tuberculosis listed by the WHO. The prevalence of pediatric tuberculosis is about 1% of the total population. However, the data on the majority of risk factors for pediatric tuberculosis in Indonesia is still scarce. Aim: This research aims to describe the risk factors for pediatric tuberculosis in Indonesia. Method: This is a single-centre, cross-sectional research involving pediatric tuberculosis patients who underwent treatment in Pasirian Hospital, East Java. We collected demographical data and risk factors for pediatric tuberculosis using questionnaires and data from medical records. Result: The most prevalent risk factors for pediatric tuberculosis is contact with the positive case (87.1%), Lymph node enlargement (77.4%), and positive radiological finding (74.2%). Conclusion: This study describes the risk factors associated with pediatric tuberculosis in Pasirian Hospital. The result of the study shows that most patients had contact with positive cases, enlarged lymph nodes, and positive radiological findings.

Keywords: Indonesia; pediatric; risk factors; tuberculosis

INTRODUCTION

Tuberculosis is a disease caused by *Mycobacterium tuberculosis*. Worldwide, tuberculosis incidence is 10.2 million cases per year, accounting for 1.3 million deaths annually.[1] Among those cases, approximately 1 million cases are in children, with about 75% occurring in high-burden countries.[2] Research has shown that the majority of pediatric tuberculosis case with positive smear test is in Africa and Southeast Asia.

Indonesia is one of the top four high-burden countries for tuberculosis listed by WHO, along with India, Bangladesh, and Sub-Saharan Africa.[3] However, the data on the prevalence of pediatric tuberculosis in Indonesia is still scarce. Data from the Indonesian National Health Research shows that the prevalence of tuberculosis in Indonesia is approximately 1%, with the prevalence of pediatric TB 0.47% in children less than one year, 0.76% in children 1-4 years old, and 0.53% in children 5-14 years old.[4]

Several risk factors predispose a child to tuberculosis infection. The main risk factor for pediatric TB is contact with an infected individual, both adult or pediatric, HIV infection, and failure to receive Bacillus Calmette-Guerin (BCG) vaccination.[5] Malnutrition is also a significant risk factor in developing pediatric tuberculosis. Research has shown that malnutrition impairs both innate and adaptive immunity against MTB, thus predisposing the individual to MTB infection. Other risk factors include vitamin D deficiency, low socioeconomic status, and exposure to air pollution.[6]

There are several single-centre studies on the risk factor for pediatric tuberculosis in Indonesia, namely in Sidoarjo[7] and Semarang[8]. However, there are no data on the risk factor for pediatric tuberculosis in Pasirian Hospital. Therefore, this research aims to describe the demographical data and associated risk factors for pediatric tuberculosis cases in Pasirian Hospital.

MATERIALS AND METHODS

This cross-sectional, descriptive research aims to describe the risk factors associated with positive TB cases from 2021-2023. Subjects were TB patients who underwent treatment in Pasirian Hospital, Lumajang, East Java. We used questionnaires to collect demographical data (age and gender) and for risk factors (nutrition status, contact with infected individual, lymph node enlargement, positive tuberculin test, and positive thorax x-ray result). Patients are eligible as subjects if they are pediatric patients aged 0-17 years old and Diagnosed with tuberculosis shown by a positive smear test or molecular test (GeneXpert®, Cepheid, California). Subjects were excluded if they withdrew consent from the research.

Nutrition status assessments were done using the WHO child growth standard Z-score for patients aged <5 years old and the 2000 CDC Growth Chart for patients aged >5 years old. Contact with infected individuals was searched using a questionnaire. Lymph node enlargement was discovered using physical examination, and a tuberculin test was conducted and interpreted according to WHO guidelines on tuberculosis. All data were calculated and presented in tables and percentages.

RESULT

We included 31 positive cases of TB in Pasirian Hospital. The median age of the subjects was 5 (0.00-17.00). The distribution of gender is relatively similar, with 14 males (45.2%) and 17 females (54.8%). Most patients had close contact with a positive case (n=27; 87.1%), and most had positive radiological findings (n=23; 74.2%). The Tuberculin test was negative (n=24; 77.4%), while lymph node enlargement was found in most cases (n=24; 77.4%).

The nutritional status assessment was conducted using the WHO growth chart for patients aged <5 years old and the 2000 CDC growth chart. The result shows that most patients had good nutritional status (n=16; 51.6%), while 13 patients had low nutritional status (41.9%), and two patients had poor nutritional quality (6.5%). Patient characteristics are presented in Table 1.

TABLE 1: Patient Characteristics.

Characteristic	Frequency (n)	Percentage (%)
Gender		
Male	14	45.2
Female	17	54.8
Nutrition Status		
Good	16	51.6
Low	13	41.9
Poor	2	6.5
Contact with Positive Case		
Yes	27	87.1
No	3	9.7
Unknown	1	3.2
Lymph Node Enlargement		
Yes	24	77.4
No	6	19.4
Positive Tuberculin Test		
Yes	7	22.6
No	24	77.4
Positive Radiological Finding		
Yes	23	74.2
No	8	25.8

DISCUSSION

The present study aims to describe the risk factors associated with pediatric tuberculosis in Pasirian Hospital. Our study shows that all patients had at least two risk factors associated with pediatric tuberculosis. Most patients have three or four risk factors, with the most prevalent risk factors being contact with positive cases and poor nutritional status.

In our study, most patients had good nutritional status, but some had low or poor nutrition. Poor nutritional quality has been associated with an increased risk of pediatric pulmonary tuberculosis. This result is by research by Tezol et al. showing that mild malnutrition was associated with higher tuberculosis incidence.[9] Conversely, high BMI is a protective factor for the incidence of tuberculosis, although this effect has not been shown in the pediatric population.[10]

Contact with positive cases was also one of our study's most prevalent risk factors. Other research has also shown that adult source case is also one of the main risk factors for pediatric tuberculosis. Buonsenso et al. reported that adult source cases could be identified in as many as 28% of pediatric TB cases and 35.3% of probable pediatric TB cases.[11] Additionally, Puryear et al. reported that approximately 3 active contacts were found for each pediatric TB case.[12] This shows that most pediatric TB cases originate from an adult case, so contact tracing should be conducted to identify the source case.

Indeed, as most cases of pediatric TB originates from an active adult case, contact tracing could identify high-risk individuals and pediatric living in close contact with an operational issue. A study by Marquez et al. suggested that more than 50% of pediatric TB genotype matches those living close to the patients. Additionally, the traditional view that only close family members can transmit the disease is probably wrong as the research shows that friends and even living in the same area could also be a possible source case.[13]

Our study found lymph node enlargement in 77.4% of all cases. Lymph node enlargement is one of the symptoms of tuberculosis often overlooked as it is not present in most cases. Buonsenso et al. reported only 15.1% of pediatric TB patients had enlarged lymph nodes in physical examination. Lymph node enlargement has been associated with younger age and negative contact cases. This is probably not due to a milder case of TB but due to a delay in diagnosis or treatment causing disseminated TB. In younger children, TB case may present as an ambiguous disease, leading to parents not seeking medical help, thus allowing the disease to progress further.[11]

A positive tuberculin test was found only in 22.6% of the cases. The Tuberculin test is used widely as a marker for immunity against Mtb caused by previous or active infection. The interpretation of a positive tuberculin test depends on the patient's risk factors.

Indonesia is one of the high-risk countries for TB according to WHO, and therefore tuberculin test was interpreted as positive when there is >10mm wheal. Tuberculin test is neither sensitive nor specific, but in high-risk individuals, the positive predictive value of a tuberculin test is excellent.[14]

The radiological finding was positive in 74.2% of our patients. Radiological finding plays a significant role in diagnosing tuberculosis in pediatric and adult patients. Primary tuberculosis manifests radiologically as pulmonary consolidation, lymphadenopathy, pleural effusion, and millitary nodules. Radiological findings in patients recovering from direct tuberculosis range from apical consolidation to cavitation.[15]

Boloursaz et al. studied the radiologic manifestation of pulmonary tuberculosis in children. The study shows that pulmonary tuberculosis manifests mainly in the right lung compared to the left lung. The most common pulmonary tuberculosis finding is lymphadenopathy (85%), followed by nodular infiltration and consolidation. However, it appears that radiological manifestation is relatively low in patients of younger age (<3 years old).[16]

Interestingly, our study found a higher number of positive radiological findings than positive tuberculin tests. Two mechanisms explain this. First, as Indonesia is a high-risk country, a positive tuberculin test is interpreted when the wheal formed in the injection site is >10mm. In our study, some patients had wheal between 5-10mm, which we interpreted as a negative tuberculin test. This might lead to lower sensitivity for the tuberculin test.

The Indonesian tuberculosis scoring system uses 8 clinical and radiological parameters in diagnosing tuberculosis. The variables are household contact, tuberculin skin test, nutritional status, fever of unknown origin for more than 2 weeks, cough for more than 3 weeks, lymph node enlargement, joint swelling, and chest X-ray results. As many pediatric tuberculosis patients do not exhibit cough or do not produce sputum, the Indonesian tuberculosis scoring system is a feasible alternative to sputum testing.[17] Our research included several parameters from the scoring system, namely contact, nutritional status, lymph node enlargement, tuberculin skin test, and chest X-ray results. The result of our study shows that these parameters are closely related to tuberculosis diagnosis, except for the tuberculin skin test, which is mainly negative in our study.

CONCLUSION

In conclusion, our study describes the risk factors associated with pediatric tuberculosis in Pasirian Hospital. The result of the study shows that most patients had contact with positive cases, enlarged lymph nodes, and positive radiological findings. However, there are several limitations to our research. Firstly, we did not conduct statistical analysis because our samples are all tuberculosis patients, making it impossible to analyze which risk factors are statistically significant. Secondly, this study was a single-centre study, meaning it is impossible to extrapolate the result of the research to a more general population. Research involving a larger sample size from multiple centres should be conducted better to describe the risk factors of pediatric tuberculosis in Indonesia.

CONFLICT OF INTEREST

The authors stated no conflict of Interest.

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REFERENCES

- [1] Kyu HH, Maddison ER, Henry NJ, Mumford JE, Barber R, Shields C, et al. The global burden of tuberculosis: results from the Global Burden of Disease Study 2015. *Lancet Infect. Dis.* 2018;18(3):261-84.
- [2] Swaminathan S, Rekha B. Pediatric tuberculosis: global overview and challenges. *Clin Infect Dis.* 2010;50(Supplement_3):S184-S94.
- [3] Seddon JA, Shingadia D. Epidemiology and disease burden of tuberculosis in children: a global perspective. *Infect Drug Res.* 2014:153-65.
- [4] Kartasmita CB. Epidemiologi tuberkulosis. *Sari Pediatri.* 2016;11(2):124-9.
- [5] Cruz AT, Starke JR. Pediatric tuberculosis. *Pediatr Rev.* 2010;31(1):13-26.
- [6] Jubulis J, Kinikar A, Ithape M, Khandave M, Dixit S, Hotalkar S, et al. Modifiable risk factors associated with tuberculosis disease in children in Pune, India. *Int J Tuberc Lung Dis.* 2014;18(2):198-204.
- [7] Oktaviani RD, Lestari P, Maranatha D, Setyoningrum RA. Profile of Tuberculosis in Children in Taman District, Sidoarjo Regency, Indonesia. *Folia Med Indones.* 2022;58(1):15-20.
- [8] Saraswati LD, Ginandjar P, Widjanarko B, Puspitasari R, editors. Epidemiology of child tuberculosis (a cross-sectional study at pulmonary health centre Semarang City, Indonesia). IOP conference series: earth and environmental science; 2018: IOP Publishing.
- [9] Tezol Ö, Alakaya M, Asuman A, Kuyucu N. Clinical and Laboratory Evaluation of Pediatric Tuberculosis Cases in Light of Nutritional Indicators. *Ankara Med J.* 2019;19(1):96-107.
- [10] Aibana O, Acharya X, Huang C-C, Becerra MC, Galea JT, Chiang SS, et al. Nutritional Status and Tuberculosis Risk in Adult and Pediatric Household Contacts. *PLOS ONE.* 2016;11(11):e0166333.
- [11] Buonsenso D, Lancella L, Delogu G, Krzysztofiak A, Testa A, Ranno O, et al. A twenty-year retrospective study of pediatric tuberculosis in two tertiary hospitals in Rome. *Pediatr Infect Dis J.* 2012;31(10):1022-6.
- [12] Puryear S, Seropola G, Ho-Foster A, Arscott-Mills T, Mazhani L, Firth J, et al. Yield of contact tracing from pediatric tuberculosis index cases in Gaborone, Botswana. *Int J Tuberc Lung Dis.* 2013;17(8):1049-55.
- [13] Marquez L, Feske ML, Teeter LD, Musser JM, Graviss EA. Pediatric tuberculosis: the litmus test for tuberculosis control. *Pediatr Infect Dis J.* 2012;31(11):1144-7.
- [14] Nayak S, Acharya B. Mantoux test and its interpretation. *Indian Dermatol Online J.* 2012;3(1):2-6.
- [15] Nachiappan AC, Rahbar K, Shi X, Guy ES, Mortani Barbosa EJ, Shroff GS, et al. Pulmonary Tuberculosis: Role of Radiology in Diagnosis and Management. *RadioGraphics.* 2017;37(1):52-72.
- [16] Boloursaz MR, Khalilzadeh S, Baghaie N, Khodayari AA, Velayati AA. Radiologic manifestation of pulmonary tuberculosis in children admitted in pediatric ward-Massih Daneshvari Hospital: a 5-year retrospective study. *Acta Medica Iranica.* 2010:244-9.
- [17] Triasih R, Graham SM. Limitations of the Indonesian Pediatric Tuberculosis Scoring System in the Context of child contact investigation. *Paediatrica Indonesiana.* 2011;51(6):332-7.