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Characteristics of Pediatric Tuberculosis Patients at Simpang Lima Gumul Hospital, Kediri, East Java

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ABSTRACT

Introduction: Pediatric tuberculosis can cause a variety of problems, including growth failure, disability, and death. In 2021, WHO recorded 10.6 million individuals had tuberculosis globally, with pediatric tuberculosis accounting for 11% of these cases. Indonesia is the second highest high-burden country for tuberculosis, according to the WHO. Children with tuberculosis often present non-specific and uncommon symptoms, making diagnosis challenging and frequently delayed. This study aims to present an overview of the characteristics of pediatric tuberculosis patients at Simpang Lima Gumul Hospital in Kediri, East Java.

Material and Methods: This was a descriptive retrospective study with a cross-sectional method. Pediatric tuberculosis patients who received treatment at the Simpang Lima Gumul Hospital in Kediri, East Java, were the subject of research. We compiled pediatric tuberculosis patients' demographic data and clinical characteristics using medical records.

Results: Sixty-one children included in the study. Most of them were male (56%) between 1 to 5 years old (52%). Seventy-two percent had a positive tuberculin skin test; chronic cough was noted in 69% of cases. An adult contact history of tuberculosis was reported in 64% of cases, while 61% had radiographic findings from TB. 52% also had fever, 51% had lymphadenopathy, and 72% had good nutritional status.

Conclusion: Tuberculosis occurs most commonly in male children 1 to 5 years of age. The most common symptoms of pediatric tuberculosis include a positive tuberculin skin test, chronic cough, contact with adults with tuberculosis, positive radiographic findings, fever, and lymphadenopathy.

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INTRODUCTION

Pediatric tuberculosis (TB), also known as TB disease in children younger than 15 years old, is a significant public health issue as it can potentially cause various problems, including cases of failure to grow, disability, and even death [1]. World Health Organization (WHO) reported that TB is present in all nations and age groups. TB is the second most common infectious killer after COVID-19 worldwide. Globally, there were 10.6 million TB cases reported in 2021; pediatric TB is 11% of cases.

Indonesia is the second of the top four countries with a high TB burden, according to the list from WHO [2]. It was found that only 9.3% of under five years old children with household contacts of TB patients were on TB preventive medication. Thirty-five percent of TB cases in children were not reported to Indonesia's National TB Program [3].

In most children, the initial infection of TB bacteria is eliminated by the host immune system, and the individual showed no symptoms. However, residual bacilli may become reactive and cause TB disease [4]. TB disease is caused by a bacteria called Mycobacterium TB and most often attacks the lungs. The transmission happens when people with lung TB cough, spit, or sneeze, allowing the TB bacteria to become airborne [5].

Diagnosing pediatric TB is difficult. There are several scoring systems and algorithms for diagnosing TB in children. The Indonesian Society of Pediatrics has developed a scoring system to help diagnose pediatric TB, such as contact history with TB patients, a positive tuberculin skin test (TST), the status of nutrition, fever, chronic cough, lymph node enlargement, bone or joint

swelling, and radiological findings. Nevertheless, some primary healthcare providers in Indonesia did not have facilities to perform TST or chest X-rays, making underdiagnosis and overdiagnosis common [6].

In Indonesia, several studies have been published on the characteristics of pediatric TB, such as studies in Tangerang [7], Jember [8], and Sidoarjo [9]. However, there is no data from Kediri. East Java Health Service in 2021 reported that Kediri ranked 12 from 38 regencies and cities in East Java with the most case of TB [10]. This study aims to provide an overview of the characteristics of pediatric tuberculosis patients at Simpang Lima Gumul Hospital in Kediri as an initial step in diagnosing different types of pediatric TB symptoms.

MATERIAL AND METHODS

This descriptive retrospective study used a cross-sectional methodology to identify the elements, characteristics, and properties of a phenomenon. Initially, the procedures started with data collection, analysis, and interpretation.

This study was conducted at Simpang Lima Gumul Hospital, Kediri, East Java, Indonesia, between December 2022 and March 2023. The sampling method were total sampling, and 61 samples that were documented in medical records were used. The inclusion criteria in this study were pediatric patients (aged 0-15 years), diagnosed with TB, scored 6 or higher by the TB scoring system, both male and female. Subjects were excluded if data were missing or unknown.

The research was approved by Simpang Lima Gumul Hospital which proved by the existence of a research permit. In order to maintain privacy, the information collected was deidentified and rendered anonymous before analysis. Ethics approval for this study was granted by the Health Research Ethics Committee Institute of Health Science STRADA Indonesia (No.3876/KEPK/VII/2023). Informed consent was waived because of the retrospective nature of this study, which was approved by Research Ethics Committee. The study was conducted in accordance with the Declaration of Helsinki.

We recorded demographic (age and sex) and clinical features (chronic cough, prolonged fever, positive TST, contact history of adults with tuberculosis, radiographic findings, lymphadenopathy, nutritional status, and bone or joint swelling) from medical record data. Chronic cough, prolonged fever, and contact history of TB cases were assessed using medical histories entered by pediatricians in the medical record. Lymphadenopathy and bone or joint swelling were assessed by the pediatricians. Nutritional status was assessed using the Child Growth Standard Z score by WHO for patients under 5 years of age and the CDC Growth Table 2000 for aged older than 5 years old. TST was performed and interpreted according to the WHO guideline on tuberculosis. Radiological findings were assessed by a radiologist. The data were collected then presented in tables and percentages.

RESULTS

The population of this study was 76 patients with positive cases of pediatric TB in Simpang Lima Gumul Hospital. Around 80% of them (61 patients) meet the inclusion and exclusion criteria. Most patients were children aged 1-5 years (n=32; 52%). There were more male pediatric TB patients (n=34; 56%) than females (n=44%). Most patients had positive TST (n=44; 72%) and had close contact with TB-positive cases (n=39; 64%). The majority of clinical signs and symptoms were chronic cough (n=42; 69%), fever (n=32; 53%), and lymphadenopathy (n=31; 51%). Majority of patients had good nutritional status (n=44; 72%), while other patients had poor nutritional status (n=17; 28%). No single patient had bone or joint swelling. Radiographic findings of TB were found in most cases (n=37; 61%) (Table 1).

DISCUSSION

According to World Health Organization, males are more likely than females to contract and pass away from TB. TB infection affects more than 500,000 males worldwide, ages 0 to 14 [2]. More than 30,000 cases of TB in males aged 0 to 14 have been documented in Indonesia [3]. This study found that most pediatric TB patients in Simpang Lima Gumul Hospital were male (56%). Another study in Sidoarjo also showed that pediatric TB cases were higher in males than in females (51.6%) [9]. Meanwhile, another study in Jember showed that the majority of pediatric TB patients are female (53.1%) and male (46.9%) [8].

According to the study's findings, children between the ages of 1 to 5 had a higher percentage of TB cases compared to other age groups. Particularly, 52% of cases were found in children in this age group at Simpang Lima Gumul Hospital. This outcome is consistent with a study in Jakarta between 2015 and 2018, which discovered that the majority (56.4%) of all pediatric TB cases occurred in children under five [11]. This finding differs from a prior study's findings, which indicated that children older than five were more likely to develop TB [9].

Pediatric TB is more common in younger children (under five years old) due to the immature immune system makes them more vulnerable to infections such as TB. In addition, children in this age group often engage in close contact with infected family or

Table 1. Characteristics of Pediatric TB Patients Based on Demographical, Nutritional Status, Contact History, Clinical Symptoms, and Radiological Findings

Characteristics	Frequency(*n*)	Percentage (%)
Gender		
Male	34	56
Female	27	44
Age Group		
<1 year	11	18
1-5 years	32	52
6-10 years	12	20
>10 years	6	10
Nutrition Status		
Good	44	72
Poor	17	28
Contact with Positive Case		
Yes	39	64
No	22	36
Lymphadenopathy		
Yes	31	51
No	30	49
Positive TST		
Yes	44	72
No	17	28
Bone or Joint Swelling		
Yes	0	0
No	61	100
Positive Radiological Finding		
Yes	37	61
No	24	39
Types of Radiological Finding		
Infiltrate	27	64
Lymphadenopathy	17	40
Consolidation	14	33
Ghon focus	1	2
Pleural effusion	2	5

caregivers, thereby increasing their risk of infection. Furthermore, children may not be able to communicate their symptoms, which may delay diagnosis and treatment, increasing the risk of complications and death. In some countries, children under the age of 5 may not be able to receive TB screening and treatment services, leading to a low report and inadequate treatment [2]. Around 1.1 million cases and 230,000 deaths (80% of which included children under five years old) were documented globally, especially in underdeveloped nations with inadequate public health infrastructure [12].

In this study, nutritional status was assessed using the child growth standard Z-score by the WHO for patients younger than 5 years old and using the Growth Chart CDC 2000 for patients aged older than 5 years old. Most patients had good nutritional status (72%), while other patients had poor nutritional status (28%). A study conducted in South Kalimantan also found the same result that the majority of pediatric TB patients had normal nutritional status (52.8%), followed by patients with mild malnutrition (27.8%), moderate malnutrition (15.7%), and severe malnutrition (3.7%). The study also discovered that malnutrition leads to a more severe TB disease and longer hospital stays [13]. Another study in Sukabumi found that 29% of pediatric TB patients were malnourished and was associated with a higher risk of treatment failure and death [14].

The reason for this finding is; with good nutrition, a child's immune system still can be vulnerable to TB if they come into close and prolonged contact with an infected person. Good nutrition can support a child's immune system, but does not make them completely immune to TB [15]. Preventive measures such as vaccination (e.g., Bacillus Calmette-Guérin or BCG vaccine) and adequate infection control remain critical to reducing the risk of transmission of TB in children [18].

Malnutrition is a common comorbidity that can worsen disease progression. TB Infection can lead to

loss of appetite, which in turn can lead to reduced food intake and lead malnutrition. Children with TB may not feel like eating due to fatigue, weakness, or other symptoms of illness, which can lead to a decrease in nutrient intake over time [19]. On the other hand, TB infections increase the body's metabolic demands and thus the need for calories and nutrients. Malnourished children may not be able to meet these increased needs, resulting in further loss of nutrient stores. This increased need for nutrients is due to the body's immune response to the infection, which requires more energy and nutrients to fight the bacteria [20].

A history of contact with positive TB people is known as an important risk factor for developing pediatric TB. When a child has close contact with a person who has active TB, he or she may inhale the bacteria and become infected. Children with weakened immune systems, such as those who are malnourished or have other health problems have a higher risk of contracting TB when they are exposed to the bacteria [21]. Contact history with a positive TB person is an important indicator for the Indonesian scoring system used in the diagnosis of pediatric TB. The family as the closest contact with the TB patients has the potential to spread the disease. If the family has a large number of family members, the risk of transmission also increases. Children who have been exposed to TB bacteria may develop latent TB infections, which means that they have the bacteria in their bodies but do not show any symptoms and are unable to spread the disease to others. But if their immune system is compromised, the bacteria may become active and result in TB disease [22].

This study showed that the contact history of adults with TB was 64%. The study conducted in Sidoarjo also showed the same result, 86.7% of children with TB had a contact history with TB patients [9]. In an Indonesian national household survey, researchers examined factors associated with pediatric TB infection. The researchers found that previous contact with a TB patient was strongly associated with pediatric TB. Comparing children with and without a positive contact history, children with a positive contact history were more than five times more likely to test positive for TB [23].

Most patients have lymphadenopathy (51%). According to prior research, cervical lymphadenopathy is the most common clinical symptom of children's TB, affecting more than half of all cases. The study also discovered that certain conditions, such as HIV coinfection and delayed diagnosis, may increase the risk of cervical lymphadenopathy in children with TB. The presence of TB in the body can stimulate the immune system, leading to activation and enlargement of the lymph nodes in the affected area [24]. In pediatric TB, lymphadenopathy most commonly affects the cervical lymph nodes. This is a lymph node located in the neck. The cervical lymph nodes are important for the host immune system and play an important role in fighting infections of the head and neck. When TB infects the lymph nodes, they can become enlarged and painful to the touch. This can sometimes lead to the formation of abscesses or pus collections that may need to be drained. In some cases, lymphadenopathy may be the only visible symptom of pediatric TB, making it an important diagnostic sign [25].

Positive TST results showed in most patients in this study (72%). This is also shown in a study conducted in China, data from 300 pediatric patients with TB were analyzed. It found that the frequency of positive TST results was 92.0%, indicating that TST is a valuable diagnostic tool for pediatric TB [26]. The TST assesses the immunological response of tuberculin-purified protein derivative (PPD) which is intradermally injected into the subject's forearm. RT23 is the type of PPD that is most popular worldwide. The RT23 is WHO and International Union Against Tuberculosis and Lung Disease recommendation. TST works with a mechanism called delayed-type cell-mediated hypersensitivity reaction to tuberculin antigens, which results in local induration of the skin within 48-72 hours. The test result is ready to asses after 48-72 hours of injection. A positive result is when the skin induration of 10mm or more in children under 5 years old or in children and adults who have been in contact with adults from high-risk groups, the 5mm induration is the threshold for children with immunocompromised conditions, children who severely malnourished, children with HIV and children who have had recent contact TB [5].

This study showed that none of the pediatric TB patients had bone or joint swelling, which is in line with the Wallgren Time Table of TB which states that it takes several years for bone and joint swelling to develop [27]. Bone and joint involvement in pediatric TB occurs when the bacterium Mycobacterium TB spreads to the bones and joints. Inflammation may result from the bacteria getting into the joints or bones and triggering an immune system response. The inflammation can cause the affected area to become swollen, red, and painful. Furthermore, the bacteria may destroy bone or joint tissue in the affected area, this may result in deformity and limited movement. The bacteria may occasionally cause pus collections or abscesses in the bone or joint [28].

The radiological findings were positive in 69% of our patients. The most lesion in this study was infiltrates in 69% of the patients (n=24). Othe lesions were Nodular Lymphadenopathy, consolidation, pleural effusion, and Ghon Focus. This is in line with previous study in Jember, 64.9% of 77 cases of pediatric TB showed single lesions, and 16.3% were multiple. The miliary lesion was the most common single lesion detected (16.9%),

and the most common lesion found in multiple groups was lung infiltrate with pleural effusion (4.2%) [8].

Interestingly, in our study, we found that the most common characteristic is positive TST result. This might be explained by three mechanisms. First, Indonesia is a country with a high burden of TB, high exposure to TB in the community may result in a positive TST. Second, the BCG vaccine is commonly used in Indonesia and other countries with high-burden TB, which may result in a positive TST and may lead to false positive TST results. Third, poor ventilation and crowded living situations can raise the chance of contracting tuberculosis. And the last, due to the development of their immune systems, children may be more susceptible to TB infection. Higher rates of positive TST results could result from this.

CONCLUSION

Children of male sex, aged 1 to 5 years, are the most affected by tuberculosis. Positive TST is the most common characteristic found in patients, other common characteristics found were chronic cough, contact history of adults with tuberculosis, radiographic findings, fever, and lymphadenopathy. Most TB patients had good nutritional status.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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