Jurnal Analis Medika Biosains (JAMBS)
Vol.12, No.01, March 2025, pp. 7-14 http://jambs.poltekkes-mataram.ac.id/index.php/home
E-ISSN: 2656-2456 DOI: https://doi.org/10.32807/jambs.v12i1.361

Immune Response Analysis of Children with Pulmonary TB Using Immuno Chromatography Test -Tuberculosis (ICT - TB)

Pancawati Ariami[1], Astriani[2], Nurul Inayati [3], Ari Khusuma[4]
[1-4] Department of Medical Laboratory Technology, Poltekkes Kemenkes Mataram, Indonesia
Email: astricherit@gmail.com

Article Info

Article history :

Received July 4th 2024
Revised March 14th 2025
Accepted March 17th 2025

Keyword :

Pulmonary Tuberculosis, Childhood Tuberculosis, Immune System, Immunochromatography (ICT-TB).

ABSTRACT

Risk factors that increase the spread of Mycobacteria tuberculosis to family members are a history of contact with tuberculosis sufferers and overcrowding at home. If the child has family or close contact with a positive TB sufferer, screening is necessary. Close contact means children live in the same house or often meet the patient. TB testing involves taking sputum samples, but in reality officers often have difficulty taking sputum samples, especially children, so they have to carry out an immunochromatography-tuberculosis (ICT-TB) test. ICT-TB is a serological examination that functions as an alternative screening examination for children who have difficulty collecting sputum. To determine the immune response in children suffering from tuberculosis using the immunochromatography tuberculosis test (ICT-TB). This research is an analytical observational study with a cross-sectional design and uses a saturated sampling method where the entire population is sampled. Purposive sampling was then used to select samples during household visits so that a total sample of 44 samples was obtained. In a sample of 44 children suffering from pulmonary tuberculosis, all ICT-TB test results were negative. 55% of children with suspected pulmonary TB were boys and 45% were boys, the number of children with suspected TB in the 1st, 2nd, 3rd, 4th, 5th and 6th months of treatment was 4.2% and 16.7% respectively. %, 21%, 16.7 %, 33.3%, 8.3% and 18.3%. Based on observations of the children's health status, 43% were healthy and 2% were sick, and in terms of physical factors, the suspect's house had good physical environmental factors. All 44 suspected children had negative ICT-TB test results. Further research needs to be carried out using cohort studies, observing the development of children with tuberculosis over a period of ± 1 to 2 years, and studying contacts in families of non-children aged 0 to 14 years.

INTRODUCTION

Tuberculosis (TB) is a health problem that has long been faced by many countries in the world, including Indonesia. Tuberculosis (TB) is an infectious disease caused by the bacterium Mycobacteria tuberculosis. Tuberculosis mainly attacks the lung parenchyma (pulmonary tuberculosis), but these bacteria are also capable of infecting other organs (extrapulmonary tuberculosis) (Ministry of Health of the Republic of Indonesia, 2020). According to the WHO Global Tuberculosis Report 2021, the number of tuberculosis cases worldwide has reached 9.9 million (WHO Global Tuberculosis Report, 2021). Indonesia is one of the countries with the highest burden of tuberculosis burden in the world, with an estimated number of tuberculosis patients reaching 824,000 (WHO Global Tuberculosis

How to cite: Ariami, P., Astriani, A., Inayati, N., & Khusuma, A. (2025). Immune Response Analysis of Children with Pulmonary TB Using Immuno Chromatography Test -Tuberculosis (ICT - TB). *Jurnal Analis Medika Biosains (JAMBS), 12*(1). doi:https://doi.org/10.32807/jambs.v12i1.361

Report, 2021). Ministry of Health (MOH) reports: "One of the factors causing the number of TB cases to reach 38,707 are cases of tuberculosis in children" (Ministry of Health, 2022).

Research Results Yustikarini & Magdalena (2015): Risk factors for increased Mycobacteria tuberculosis infection in family members are suspected contact history with HIV patients with tuberculosis and crowded living conditions at home.

Mycobacteria tuberculosis is easily transmitted through the air through droplets in homes where ventilation, air circulation, humidity and the number of clustered household members make exposure to Mycobacteria tuberculosis last longer and increase the risk of transmission of Mycobacteria tuberculosis to other family members (Yustikarini & Magdalena, 2015). According to research by Anur Afifah (2019), the immune system of a person, especially a child, affects the incidence of tuberculosis in children, especially the child's contact history with people infected with tuberculosis in the family home environment (Afifah, 2019). If the child has had direct contact, contact in the same house with a person who is positive for tuberculosis, it is necessary to conduct examination and testing. Therefore, prevention efforts are needed to avoid an increase in pediatric tuberculosis cases, especially to find out whether children have been exposed.

The results of research by Apriliasari et al. (2018) on the history of contact with tuberculosis patients showed an association with the incidence of pulmonary tuberculosis in children with a 3.1-fold higher risk of developing pulmonary tuberculosis compared to those who were not exposed to adult TB patients (Apriliasari et al., 2018).

Puskesmas Taliwang is one of the health centers in West Sumbawa Regency. Puskesmas Taliwang is also one of the health centers with the largest population of 56,337 people. Puskesmas Taliwang in 2022 reported that the total number of patients with mmune losis reached 88 cases, while for 2023 there was an increase in the number of patients with mmune losis to 94 cases (DHO West Sumbawa, 2023). Patients who show clinical symptoms of TB will be immediately examined for sputum using the Molecular Rapid Test (TCM) tool, GeneXpert. If there is a positive result of GeneXpert examination, active family and community-based discovery will be carried out through contact investigation activities on children who are in close contact with TB patients. What is meant by close contact is children who live in the same house or are often in direct contact with TB patients by taking sputum samples, but what happens in the field is that officers often have difficulty getting sputum samples, especially children, which can hamper contact investigation activities and the TB case finding program at Puskesmas Taliwang.

In children with clinical symptoms of TB, tuberculin examination is usually recommended, but the reading of the results on the tuberculin test takes a long time, namely after 48-72 hours since the test was carried out, also in the tuberculin examination must wait for 10 suspects first before the examination can be carried out. Therefore, in this study, researchers wanted to examine TB in children who were in close contact with patients who had difficulty collecting sputum samples by screening using immuno chromatography test-tuberculosis (ICT-TB) which aims to determine the immune response of children from patients with pulmonary TB. The immuno chromatography test-tuberculosis (ICT-TB) method is a serology test as an alternative TB screening examination for suspects who have difficulty collecting sputum (Nusahi, 2018).

This study aims to determine the immune response in children of TB patients using the immuno chromatography test-tuberculosis (ICT-TB).

MATERIALS/METHOD

This study was an analytic observational study with a cross-sectional approach, specifically by making measurements or observations at the same time or in one session. The

data used were primary data of children suspected of pulmonary tuberculosis in the working area of the Taliwang Health Center who were still receiving treatment and met the inclusion and exclusion criteria.

RESULTS AND DISCUSSION

Table 1. ICT-TB test results in children of patients with pulmonary TB

No	Suspect Code	Gender	Age (Year)	ICT-TB Test Result
1	HBA	M	9	Negative
2	FRS	F	11	Negative
3	FLA	F	7	Negative
4	MAG	M	8	Negative
5	MAP	F	4	Negative
6	HMO	F	2	Negative
7	JAP	M	10	Negative
8	FTR	F	9	Negative
9	WNL	F	13	Negative
10	DML	F	5	Negative
11	ARL	M	4	Negative
12	SDC	M	11	Negative
13	ASA	F	7	Negative
14	NDZ	F	2	Negative
15	HRT	M	7	Negative
16	ASB	M	4	Negative
17	HSB	M	2	Negative
18	MDA	M	6	Negative
19	TMA	F	1	Negative
20	KPW	M	7	Negative
21	GRB	M	4	Negative
22	ARZ	M	1	Negative
23	MTG	M	8	Negative
24	MAI	F	8	Negative
25	AFR	M	1	Negative
26	FRY	F	5	Negative
27	MHU	M	5	Negative
28	MHS	M	7	Negative
29	KWH	F	5	Negative
30	FTN	F	3	Negative
31	YSI	F	10	Negative
32	SRP	F	4	Negative
33	MAT	M	5	Negative
34	ABZ	M	2	Negative
35	RZA	M	1,7	Negative
36	GBI	M	13	Negative
37	GBR	M	11	Negative

No	Suspect Code	Gender	Age (Year)	ICT-TB Test Result
38	MGZ	M	2	Negative
39	AFF	F	3	Negative
40	AFZ	F	0,3	Negative
41	MAA	M	13	Negative
42	EZN	F	10	Negative
43	MHR	M	3	Negative
44	RSK	F	4	Negative

Table 1 shows the data of ICT-TB examination results in children of pulmonary tuberculosis patients as many as 44 respondents, all of whom were negative. Furthermore, the researchers conducted a comparison with the TCM Genexpert test using the sputum of children with pulmonary tuberculosis in 9 respondents among the same patients who were able to produce sputum, aged 10 to 14 years. These were the results achieved.

Table 2. Children's TCM Genexpert Examination Results from Patients with Pulmonary TB aged 10-14 th

No	Suspect Code	Gender	Age (Year)	TCM Genexpert Test Result
1	FRS	F	11	Negative
2	JAP	M	10	Negative
3	WNL	F	13	Negative
4	SDC	M	11	Negative
5	YSI	F	10	Negative
6	GBI	M	13	Negative
7	GBR	M	11	Negative
8	MAA	M	13	Negative
9	EZN	F	10	Negative

Due to the difficulty of sputum sampling in children with direct sputum, children aged 10 years and above may require sputum expectoration, so a TCM test was conducted to confirm the results of the ICT-TB examination, because among the 44 children tested who could expectorate sputum, there were only 9 who could expectorate sputum. The researchers only observed nine respondents.

Table 3. Distribution of Respondents based on gender Children of patients with pulmonary TB examined using the Immuno chromatigraphy test-tuberculosis (ICT-TB).

Gender	Frequency	Percentage
Male	24	55 %
Female	20	45 %
Total	44	100 %

Table 3 shows the distribution of respondents based on gender when examined by tuberculosis immunochromatographic test (TBICT), the number of men was 24 people (55%) and the number of women was 20 people (45%). And in Table 4 the gender distribution of respondents according to the survey using TCM Genexpert, the number of men was 5 people (56%) and the number of women was 9 people (44%).

Table 4. Distribution of Respondents by gender Children of patients with pulmonary tuberculosis examined using TCM Genexpert

Gender	Frequency	Percentage
Male	5	56 %
Female	4	44 %
Total	9	100 %

Table 5. Distribution of the treatment process of patients with pulmonary TB

Treatment	Frequency	Percentage
Month-1	1	4,2%
Month-2	4	16,7 %
Month-3	5	21 %
Month-4	4	16,7 %
Month-5	8	33,3 %
Month-6	2	8,3 %
Total	23	100 %

Frequency of treatment Month 1 1 4.2% Month 2 4 16.7% Month 3 5 21% Month 4 4 16.7% Month 5 8 33.3% Month 6 2 8.3% Total 23 100% From table 5, it can be seen that the distribution of respondents based on the treatment of pulmonary tuberculosis patients in the first month was 1 person (4.2%), the second month was 4 people (16.7%), the third month was 5 people (21%). April was 4 people (16.7%), May was 8 people (8.3%), and the sixth month was 2 people (8.3%).

Table 6. Distribution of respondents based on health conditions

Health Condition	Frequency	Percentage
Healthy	43	98 %
Sick	1	2 %
Total	44	100 %

The distribution of respondents based on health status was 43 people (98%) healthy and 2 people sick (2%). What is meant by healthy is that when researchers took samples, the people surveyed were in good physical condition, actively playing and there were no complaints such as coughing and fever which are signs of illness in people suspected of

having TB. While at the time of sampling there were 2 people who were sick with fever. Immuno chromatography test-tuberculosis (ICT-TB) test on children with suspected pulmonary tuberculosis in the working area of Puskesmas Taliwang was 44 respondents. Based on data analysis, 44 children with pulmonary tuberculosis aged 0 to 14 years surveyed were tested with an immuno chromatography test-tuberculosis (ICT-TB) test with negative results.

By observing the results of the ICT-TB test, researchers tried to conduct the GeneXpert TCM test on children who were able to take sputum to confirm the results of the ICT-TB test, because the GeneXpert TCM test is one of the reference tests for the diagnosis of pulmonary tuberculosis, Molecular Rapid Test (TCM) with GeneExpert tools using the RT-PCR method based on repeated amplification of target DNA. In vitro research showed a detection limit of Mycobacteria tuberculosis of at least 131 bacteria/ml sputum (Kurniawan et al., 2016) and collected 9 children whose sputum was suspected, of which 9 children tested negative.

This ICT-TB test uses immunochromatography which is one of the TB tests to detect antibody responses to Mycobacteria tuberculosis. A valid explanation of the result is the formation of a red color on the special control line. If the test line does not show red color, the test result is invalid or does not meet the quality management requirements (Meri et al., 2022).

Based on research by Mursalim et al. (2020) also explained that the sensitivity of the ICT-TB method still has limitations, namely its sensitivity and specificity are still low, this is because the sensitivity of the ICT-TB method cannot detect very small TB bacteria. Immunochromatography test is one of the screening tests and the processing time is relatively faster, about 15 minutes. Because immunochromatography is screening, additional confirmatory testing is needed with more accurate tests, such as Genexpert TCM. So, the researchers tested the same people who may have had sputum in children aged 10-14 years with TB, and 9 tested negative.

The results of the study described by Rita & Siti (2020) showed that the possibility of contracting pulmonary tuberculosis in contact with a positive patient is approximately three to 4 times higher than in contact with a negative patient. If a child has close contact (i.e., the child lives in the same house or is often in contact with a positive TB patient) with a patient with pulmonary tuberculosis, then the child has a higher risk of contracting the disease and after being infected, the child will be in a hospital in a worse condition with a high risk of developing tuberculosis (Directorate General of Disease Prevention and Control, 2016). This is in accordance with the researcher's observation in the field, where more than one child aged between 1 and 14 years lived in the same house with an adult with tuberculosis (Rita & Siti M.Q., 2020).

The physical environment of the house is also associated with the incidence of tuberculosis disease, especially ventilation of the house area, room lighting (living room, family room and bedroom), type of house wall, room air humidity (Susiani Wulandari, 2012). This is in accordance with the researcher's observation in the field that the respondents' houses visited had a good physical environment. The incubation period of tuberculosis ranges from two to twelve weeks and usually lasts between four to eight weeks. During the incubation period, the bacteria multiply until they reach a population of 1000, a number sufficient to stimulate a cellular immune response (Directorate General of Disease Prevention and Control, 2016). This is in accordance with the researcher's experience in the community that recording the history of tuberculosis in children requires additional examinations and a long period of time to monitor the child's condition of about 2 months,

which may be the time required from the time the germs invade until the symptoms of the disease appear.

The results also concluded that there was no significant relationship between contact with tuberculosis patients and the incidence of pulmonary tuberculosis in children. This is not in accordance with the results of Fitriani's research (2013) which suggested that the level of TB transmission in the patient's home environment is quite high, the average patient can infect other people in their home with a very high risk of transmission.

In households with many people, the number of TB patients is four times higher than households with only one TB patient. This is because the presence of TB patients in the home and surrounding areas increases the number and duration of exposure to TB germs, which is an important factor in TB pathogenesis. Although the incidence of pulmonary tuberculosis in children with household contact is 2 (5.9%), the national tuberculosis control indicator based on suspicious screening data shows that the association between contact and exposure to tuberculosis and the incidence of pulmonary tuberculosis in children is a value that should not exceed 35% (DG P2P, 2016).

From the results of the study, Maria (2020) also explained that there was a significant relationship between family knowledge and behavior aimed at preventing tuberculosis transmission. This is similar to what researchers have experienced in this field, namely the existence of self-awareness in the patient's family. in one house, specifically the patient always wears a mask when living and interacting with the family, when eating the patient is isolated from other family members, especially in a separate bed during treatment (Maria, 2020).

Tuberculosis can be transmitted through the patient's saliva or sputum when talking, or when talking directly with family members, and if a splash containing Mycobacteria tuberculosis enters the lungs, this bacteria will live and multiply by dividing in the body spreading to the bloodstream, lymphatic, or other places such as the respiratory tract. Household density is the number of people living in the same household as the index case. It has long been assumed that household density affects the incidence of tuberculosis. In theory, in dense housing, transmission is easier to occur because children are closer to cases (Rita & Siti M.Q, 2020).

Based on research by Morika et al. (2021), it is also explained that there is an association between BCG vaccination and the incidence of pulmonary tuberculosis in children. One of the efforts of the government and the world to prevent childhood tuberculosis is BCG vaccination. BCG vaccination is the act of injecting live attenuated vaccines, specifically attenuated Mycobacteria Bovis bacteria to make vaccines. Vaccination is given under the Immunization Development Program to infants aged 0 to 2 months. This is in accordance with the experience of researchers in the field, where children have received complete vaccinations (Morika et al., 2021). Children under 5 years old were not given BCG vaccination, which plays a major role in the incidence of tuberculosis in children under 5 years old. It is understood that children who do not receive BCG vaccination can increase the incidence of tuberculosis in children under 5 years old. Thus, BCG vaccination can be said to reduce the risk of tuberculosis disease in children under 5 years old (Sjahriani & Neneng, 2016).

CONCLUSIONS

The results of observations of the health status of 43 healthy children and 2% of sick children, in terms of physical factors, the suspect house has good physical environmental factors. All 44 suspected children had negative ICT-TB test results. There are no children

infected with Mycobacterium Tuberculosis in children of patients with Pulmonary TB who live in the same house.

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