ORIGINAL ARTICLE

Tuberculine Test in Infants and Children Who Have Contact to Sputum Positive Adult Pulmonary Tuberculosis Patients

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ABSTRACT This study aimed to determine the pattern of pulmonary tuberculosis infection in infants and children who had household contact to adult tuberculosis patients with sputum positive for acid-fast bacilli (AFB). Tuberculine (Mantoux) test was performed in 270 such infants or children. The results showed that tuberculine test positivity in household contact group of adult tuberculosis patients with positive AFB sputum were significantly different from patients with negative AFB sputum for the age groups 0-18, 0-14, 0-4, 5-9, 10-14 years but not for 15-18 age group. There were no significant difference in positivity of tuberculine test result according to gender or BCG vaccination status, but there was significant difference between children who slept in the same bed room with the source case and those who did not. Semi-quantitative bacteriological status of the sputum (AFB +, or ++ or +++) did not affect positivity of tuberculine test result. We conclude that infants and children with household contact to sputum positive adult pulmonary tuberculosis patients are at high risk for developing tuberculosis infection particularly those who sleep in the same bed room with the source case. **[Paediatr Indones 1999; 39:221-228]**

Introduction

Tuberculosis remains a health problem throughout the world, but rates are particularly high in many developing areas.[1,2] In Indonesia many tuberculosis patients are found and remains a large health problem.[3,4] Household health survey result in 1992 revealed that tuberculosis ranked the second as the cause of death, while a decade

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before it was the tenth.[5] Currently, it is estimated that annually as many as 500,000 new cases of pulmonary tuberculosis are found with 175,000 deaths.[6]

The primary transmission of tuberculosis is through the airbone route by nucleus droplets inhalation that contain tubercle bacilli as infectious particles.[3,5,7,8] Children who have close contact to adult pulmonary tuberculosis patients have a high risk for tuberculosis infection.[7,9,10] One of the most helpful and sometimes most crucial in establishing the diagnosis of tuberculosis in infants and children is the elicitation of a history of exposure to an adult patient with active pulmonary tuberculosis, and tuberculin skin test to those children.[11] Tuberculin skin test is the primary method of identifying persons who have been infected with tubercle bacilli and is also the most rapid, cheapest, safe and reliable method of testing for tuberculosis.[11,12] This method is the most important diagnostic aid for early diagnosis in infants and children.[13] The purpose of this study was to find out the risk of infants and children as a household contact to adult pulmonary tuberculosis patients with sputum positive for AFB by using tuberculine (Mantoux) test.

Methods

This cross sectional study involved 270 infants and children who had household contact to adult pulmonary tuberculosis patients with sputum positive for AFB. The other 270 infants and children who had household contact to adult pulmonary tuberculosis patients with sputum negative for AFB were taken as a control group. In this study, adult pulmonary tuberculosis patient with either negative or positive AFB in the sputum were both ambulatory patient from The Medical Clinic for Pulmonary Disease (BP4) in Medan, in whom the first diagnosis was established on between June 1995 until February 1996.

Tuberculosis was diagnosed by the pulmonologist based on clinical symptoms and signs, chest x-ray, and sputum examination. The study was performed in 6 months. started from August 4, 1995 until February 11, 1996 by home visits.

We included infants and children aged 3 months-18 years old of age with a minimal length of household contact to the patient at least 3 months.[10] Infants and children who had either thypoid fever, pertussis, severe tuberculosis such as tuberculous meningitis and miliary tuberculosis, measles or mumps, those who had chronic renal failure, severe malnutrition, longterm therapy of corticosteroid or other immunosuppressive drugs were excluded from the study. We also excluded patients with malignant disease such as Hodgkin or non Hodgkin lymphoma, or those who had had polio or measles immunization in less than 6 weeks before were excluded from the study.

We used PPD RT23 5TU (Biofarma Bandung) for tuberculine testing, in dose of 0.1 ml intradermally injected into the central part of the volar surface of the 3th proximal part of the left fore arm. The reaction was examined at each patient's house at 72 hours after injection by measuring the transverse diameter of induration. The test was considered positive if there was induration of 10 mm or more in infants and children who had never got BCG immunization, or induration of 15 mm or more in those who had got BCG immunization.

We compared between the sample group who slept in the same bedroom with the source case and those who did not. The criteria of negative BCG immunization history was the absence of its record and BCG scar. Chi-square test was used to determine the association between positivity in both groups. The level of significance was $p<0.05$.

Results

Positive tuberculine test in infants and children ages 0-18, 0-4, 5-9, 10-14 years old was higher in sample group than control group with significant difference ($p<0.001$, <0.025, <0.01, <0.01 respectively). But for the age group of 15-18 years old, the difference was not statistically significant ($p>0.05$). The positive tuberculine test in infants and children ages 0-14 years group were found higher in sample group (47.4%) than control group (25.2%) with significant difference ($p<0.001$). (Table 2).

Positive tuberculine test in infants and children group as household contact to adult pulmonary tuberculosis patients were higher in girls (52.2%) than boys (47.8%) with no significantly difference ($p>0.05$) (Table 3).

The positive tuberculine test in infants and children as household contacts who sleeping with the source cases in the same bedroom were higher (60%) than the group who sleeping in the different bed room (44.6%) with significant difference ($p<0.025$). (Table 4). The positive tuberculine test were higher in infants and children group who had never got BCG immunization (53.1%) than who had (44.1%) with no significant difference ($p>0.05$) (Table 5). The highest number of positive tuberculine test result were found in the household contact group with bacteriologic status +++ in AFB of sputum (53.8%) and the least in ++ (45.7%) with no significantly difference (Table 6).

The tuberculine test significantly demonstrated the difference between household contact to adult pulmonary tuberculosis patients with positive AFB of sputum and negative AFB of sputum in both infants and children 3 months-18 years old group and 3 months- 14 years old group (Table 2). Shaw and Wynn-Williams, and also Loudon and Spohn (both was citated by Johnston) had found similar to this study. Infants and children who were household contacts to adult pulmonary tuberculosis patients with positive AFB in sputum were more likely infected (65% & 44% respectively) than with negative AFB of sputum on smear (17% & 14% respectively).[15] Narain and coworkers reported similar finding, positive tuberculin skin test of infants and children who were household contact to positive mycobacterium tuberculosis patients for the age group of 0-14 years was 35.3% which significantly different from negative mycobacterium (20.3%).[16]

Table 1. Characteristics of source and contact cases

		Sputum tubercle bacilli	
		Positive	Negative
I.	**Source cases**		
	total number	71	69
	age range (yr.)	16-75	16-75
	gender: male / female	38/33	50/19
	bacteriological status:		
	+	24	
	++	25	
	++	22	
II.	**Contact cases**		
	total number	270	270
	gender: male/female	136/134	137/133
	age:		
	▪ 3 months- 4 years	51	73
	▪ 5 years- 9 years	76	72
	▪ 10 years- 14 years	105	81
	▪ 15 years- 18 years	38	44

Table 2. Results of tuberculine test of infants and children by age and source case status

	Tuberculine test								
Age (year)	Sample				Control				p
	+	%	-	%	+	%	-	%	
0-4	20	39.2	31	60.8	14	19.2	59	80.8	<0.025
5-9	36	47.4	40	52.6	17	23.6	55	76.4	<0.01
10-14	54	51.4	51	48.6	26	32.1	55	67.9	<0.01
15-18	25	65.8	13	34.2	23	52.3	21	47.7	>0.05
Total	135	50	135	50	80	29.6	190	70.4	<0.001

Table 3. Association of sex and tuberculine test resultsin children with household contact to sputum positive tuberculosis patients

Sex	Tuberculine test				Total
	Positive	%	Negative	%	
Boys	65	47.8	71	52.2	136
Girls	70	52.2	64	47.8	134

df=1 x^2=1.54 p>0.05

Table 4. Association of place of sleep and tuberculine test results in children with household contact to sputum positive tuberculosis patients

	Tuberculine test				Total
	Positive	%	Negative	%	
Slept in same bedroom	57	60.0	38	40.0	95
Slept in different room	78	44.6	97	55.4	175

Table 5. Association of BCG status and tuberculine test results in children who were household contact to sputum positive patients

BCG status	Tuberculine test				Total	%
	Positive	%	Negative	%		
+	41	(44.1)	52	(55.9)	93	(100)
-	94	(53.1)	83	(46.9)	177	(100)

df=1 x^2=1.98 p>0.05

Table 6. Association of tuberculine test with bacteriologic status of source cases

Bacteriologic status	Tuberculine test				Total
	Positive	%	Negative	%	
+	50	51.0	48	49.0	98
++	43	45.7	51	54.3	94
+++	42	53.8	36	46.2	78

df=2 x^2=1.180; p>0.05

Discussion

This study revealed similar feature that the tuberculine test in sample group were significantly different from control group such as 3 months- 4 years, 5-9 years, and 10-14 years group. Tuberculous infection risk for the age group 15-18 years presented, had no significantly difference (Table 2). Narain and coworkers found that tuberculosis infection risk for the household contacts have significantly different between negative and positive microscopic sputum in the group ages 0-4 years, 5-9 years and 10-14 years old. In the age group more than 15 years old had no significantly difference. Infection risk difference between both household contact categories was most marked in the younger age groups whereas in the group 15 or more years old, the difference had almost disappeared (no significance). They also reported that the prevalence of infection rate were increased with increased in age. This was due to the effect of the spread of infection from the community was seen in older age groups, who came much more into contact with the community than did the younger age groups.

The prevalence rate for the age group 0-4 years was 1.6%, for the age group 5-9 years was 7.2%, 10-14 years was 14.1% and 15 years or more was 37.8%.[16] Our study represented positive tuberculine test percentage increased with increased in age (Table 2). Survey in Yogyakarta region (1961-1963) and rural Malang (1961-1965) revealed apparently similar result, the increased percentage of positive tuberculin skin test with increased in age that were respectively 3.4%, 11.7%, 40.6% and 59.1% for the age group of 1-4 years, 5-9 years, 10-14 years and 15-19 years.[4] This study found that tuberculous infection among girls who were household contact to adult pulmonary tuberculosis patients with positive AFB sputum was 52.2%, greater than boys but not significant statistically (Table 3).

Closeness between the source case and the contacts within the room air environment may result in increased risk of tuberculous infection for the contacts. This situation was due to more decreased air volume in the small room caused increased nuclei droplets consentration that contain tubercle bacilli.[17] tuberculine test results for the contacts who shared air with the source case in the same bedroom were significantly greater than who did not. (Table 4).

The protection efficacy of BCG immunization remains controversial issue, studies over the last 50 years have produced conflicting results.[1] WHO reported the protective benefit of BCG vaccination was extremely variable, ranging from 0-80%.[18] Putrali J et al reported that the protective benefit of BCG immunization for infants and children under 5 years old to both forms of tuberculosis about 37%.[19] Curtis HM et al found that BCG vaccination has substantially reduced the incidence of childhood tuberculosis, the suggested level of protection being above 75% for children under 15 years old.[20] Al Kasimi found that protection level BCG immunization for ages 5-14 years was 82%.[21] Karonga prevention trial group in Malawi reported BCG immunization affords none against tuberculosis.[22] Siregar AA reported that positivity results of tuberculine test in children who had got BCG vaccination have been no significantly difference from children who had not.[23] This study demonstrated that positive tuberculine test result among the household contacts to adult pulmonary tuberculosis patients with positive AFB in sputum, who had either got BCG immunization or not, have been no significantly different (Table 5). Apparently, the tuberculous infection risk among infants and children who had or had not got BCG immunization was similar in our study.

The tuberculous transmission is the highest in infants and children who were household contact to adult pulmonary tuberculosis patients with bacteriologic status of AFB sputum +++ (53.8%), +1 (51%) and the lowest in AFB sputum ++ (45.7%), but the difference was not significant. (Table 6).

To sum up, we have demonsrated that infants and children who have close contact to adult pulmonary tuberculosis patients with sputum positive for AFB are at high for tuberculosis infection. The risk even higher if a child sleeps in the same bedroom with source patient. The positivity of tuberculine test is not affected by sex, prior BCG vaccination, or number of AFB in the sputum of source case.

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