Screening for tuberculosis in a primary school in Ankara

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Tuberculosis is still an important health problem in developing countries. A screening program was conducted upon learning that one of the teachers of a primary school in Ankara was diagnosed to have active pulmonary tuberculosis. A total of 341 students in the same building with the index case were screened for tuberculosis. There were 109 students with positive tuberculin test reaction. A higher ratio of tuberculin test positivity among the students of the teacher with active tuberculosis versus students vaccinated with BCG one year previously according to the routine vaccination program was determined. Isoniazid prophylaxis was given to the students with positive tuberculin test. The study shows the importance of an urgent work-up of index cases and their environment to prevent the spread of tuberculosis.

Key word: tuberculosis screening, children, close contacts, school, tuberculosis prophylaxis.

Tuberculosis is still an important health problem, especially in developing countries. In Turkey, the incidence of tuberculosis was reported as 30.3/100,000 in 1998[1]. In some developed countries, incidence of it has started to rise, making tuberculosis a problem once again. In the United States, the incidence of tuberculosis was 9.3/100,000 in 1985, but started to rise the in 1986. This increase in tuberculosis incidence can be attributed to several factors, including the human immune deficiency virus epidemic, the immigration of large numbers of persons from countries in which tuberculosis is highly prevalent, the rise of multidrug-resistant mycobacterial organisms and the decline of tuberculosis control programs[2].

Rapid diagnosis and medical intervention is essential to prevent the spread of tuberculosis. Although the diagnostic value of tuberculin skin test in cases of malnutrition, tuberculous meningitis, miliary tuberculosis and immunosuppression is controversial, it is an easy, widely available and inexpensive method for detecting Mycobacterium tuberculosis infection, which is very important for the screening programs[3].

According to the recently updated recommendations of the Centers for Disease Control and Prevention (USA), tuberculin testing should be performed in persons belonging to risk groups, one of which includes close contacts (i.e. those sharing the same household or other enclosed environments) of persons known or suspected to have tuberculosis[2,4].

This study was conducted based on the information that one of the teachers of a primary school in Ankara was diagnosed to have active pulmonary tuberculosis. The aim of this study was to screen all the students in the school for tuberculosis who were suspected to be exposed to the index case.

Material and Methods

The index case with active pulmonary tuberculosis was the teacher of one of the first phase classes in a primary school. She was diagnosed to have active pulmonary tuberculosis by positive findings in chest X-ray and microbiologic investigations for tuberculosis. Microbiologic tests included identification of acid resistant bacillus (ARB) in sputum by acid fast stain, growth in sputum culture with the BACTEC TB system and positive polymerase chain reaction (PCR) assay for Mycobacterium tuberculosis. She had treatment for tuberculosis for nine months. After two months of treatment, ARB in sputum and culture for tuberculosis were negative. There were 32 students in the teacher's class. This

teacher was working in one of the buildings of the school with 10 classrooms, five of them to first phase and the other five to second phase. In these classrooms, there were 361 children in total. All children suspected to be exposed to the index case during breaks, in the facilities or during lunch-time in the common restaurant were included in the study. There was no air conditioning system in the school.

The children, parents and the teachers obtained oral and written information about the screening, and parents provided written informed consent for their child to participate. Parents were asked to complete a questionnaire about symptoms of their child including cough, night sweats and fever.

The children in the second phase classes were vaccinated with BCG one year previously according to the routine vaccination program in Turkey. But the children in the first phase classes had not yet been vaccinated at the time of study.

Seven children were not allowed to participate by their parents, eight were absent when the test was administered and five were absent when skin test reaction was measured. These 20 children were excluded from the study and a total of 341 were tested, including 174 children from first phase classes and 167 children from second phase classes.

All children were examined by four pediatricians, and the number of BCG scars on the left shoulders of the children were determined. A 5 tuberculin unit dose (0.1 ml) of PPD (Tuberculin Purified Protein Derivative, Biolek, Ukraine Kharkiv) was administered by two experienced persons on the middle 1/3 of the volar surface of the left arm. The same pediatricians measured the indurations after 72 hours using the ball-point pen method[5].

A transverse diameter induration of 10 mm or more in children with no BCG scars and of 15 mm or more in children with one or more BCG scars was reported to be positive[6]. The children with a positive tuberculin test reaction were invited to the hospital, and detailed physical re-examinations and chest X-rays were performed.

Results

A total of 341 children (aged 1-9 years) were screened in the study. There were 203 boys and 138 girls.

Thirty-one of 174 children (17.8%) in first phase classes and 78 of 167 children (46.7%) in second phase classes, in a total 109 children, were found to have a positive tuberculin test (Table I).

Table I. Tuberculin Test Results According to First and Second Phase Classes

	Tuberculin test result					
	Positive		Negative		Total	
Phase	No	%	No	%	No	%
1	31	17.8	143	82.2	174	100
2	78	46.7	89	53.3	167	100
Total	109	31.9	232	68.1	341	100

Out of 32 children in the class of the teacher with active tuberculosis, 11 (34.4%) had a positive tuberculin test reaction. The ratio of tuberculin test positivity was higher in this class in comparison to the other first phase classes and the difference was statistically significant ($p < 0.05$) (Table II).

Table II. Tuberculin Test Results in First Phase Classes

	Tuberculin test result					
	Positive		Negative		Total	
First phase classes	No	%	No	%	No	%
1	2	5.7	33	94.3	35	100
2	7	17.5	33	82.5	40	100
3	8	24.2	25	75.8	33	100
4	3	8.8	31	91.2	34	100
5 (Teacher's Class)	11	34.4	21	65.6	32	100
Total	31	17.8	143	82.2	174	100

The first phase and second phase students were compared in terms of tuberculin test positivity, excluding the students in the class of the teacher with active tuberculosis. The ratio of tuberculin test positivity was higher among the second phase students and the difference was statistically significant ($p < 0.05$) (Table I).

The eight of children with no BCG scar all had negative tuberculin test results. There were 249 children with one BCG scars and 80 children with two scars. The number of children in these groups with a positive skin test was 78 (31.3%) and 31 (38.7%), respectively. All four children with three scars also had negative skin test (Table III).

The physical examination and chest X-ray of children with positive test results revealed no evidence of active tuberculosis.

Parents of all children with a positive tuberculin reaction were invited to meetings organized to

inform them about skin test results and the necessity of isoniazid chemoprophylaxis (5 mg/kg/day) for the tuberculosis, to increase the compliance. Two pediatricians were present in these meetings and they answered any questions. The parents of 70 children accepted the treatment and received their prescription.

Table III. Tuberculin Test Results According to the Number of BCG Scars

Number of BCG Scars	Tuberculin test result: Positive No	Positive %	Negative No	Negative %	Total No	Total %
0	0	0	8	100	8	100
1	78	31.3	171	68.7	249	100
2	31	38.7	49	61.3	80	100
3	0	0	4	100	4	100
Total	109	31.9	232	68.1	341	100

The children were followed for six months. During follow-up only one child had a 3-fold increase of transaminases at the end of the 5th month. The child was asymptomatic and transaminase levels returned to normal after discontinuation of the drug for two weeks.

Discussion

Screening for tuberculosis is very important to prevent the spread of the disease in countries where it is prevalent.

The American Thoracic Society and Centers for Disease Control and Prevention recently issued recommendations for tuberculin testing[4,7]. In this study, the children screened for tuberculosis were in one of the risk groups according to these recommendations, which included close contacts of a known tuberculosis case in an enclosed environment. The teacher in our study with active tuberculosis was working in one of the buildings of the school containing 10 classrooms. The students in this building used the same garden, toilets, restaurant and other facility areas. All children were suspected to be exposed to active tuberculosis and were screened for the disease.

The comparison of the teacher's class with other first phase classes which had the same circumstances in terms of recent BCG vaccination revealed a higher ratio of tuberculin test positivity in the teacher's class. This result signifies a higher risk of exposure among the students sharing the same classroom with the index case. This information may be helpful for subsequent screening programs in definition of "close contacts" in such places like schools where the index case can have a large number of contacts with different degrees of exposure. In our study, because the teacher possibly had contact with other students in particular situations and because students in her class had contact with other students, it was decided to screen all the students in the building and give prophylaxis to tuberculin positive cases.

Both specificity and sensitivity of the tuberculin test are variable. On avarage, 10-25% of patients with active tuberculosis do not react to tuberculin. False negativity may be as high as 50% in patients critically ill with disseminated tuberculosis. Effective use of tuberculin testing requires an understanding of characteristics that are inherent in the test itself and of the extrinsic to the test that influence the interpretation of test results. The latter characteristics have to do with the likelihood of tuberculosis in the person or population being tested. The utility of the tuberculin skin test depends on the prevalence of cross reactions with nontuberculous bacteria. In populations with cross-reactions, the tuberculin skin test may be assumed to have a specificity of almost 99%[8].

In spite of its variable specificity and sensitivity, the tuberculin skin test is the only method for detecting Mycobacterium tuberculosis infection[8] and it is easily available and inexpensive, very important features making it widely used in screening programs.

Bacillus Calmette Guerin vaccination also influences tuberculin skin test interpretation. Especially in countries where more than one BCG vaccine is recommended, revaccination can considerably alter the tuberculin skin test response and the diagnosis of tuberculosis[9,10].

Our screening program revealed a skin test positivity of 46.7% among the children in the second phase classes, whereas it was 17.8% in the first phase classes. The second phase students received their last BCG vaccine one year previously according to the routine vaccination program in Turkey. This was also taken into consideration in the interpretation of results.

For persons who have recently had close contact with a case of active tuberculosis, skin test reactions are likely to represent infection with M. Tuberculosis. Thus, although the higher

percentage of skin test positivity in second phase students versus first phase students can be attributable to the recent BCG vaccination, it was not possible to rule out the possibility of test positivity due to exposure to the active case. As a result, all children with a positive tuberculin skin test were given isoniazid chemoprophylaxis.

Any index case of tuberculosis causes a significant problem in such places where the number of contacts is a large and vulnerable. Screening such a large number of contacts consumes time and money. Periodic screening of people dealing with susceptible groups, especially children, is more practical.

The result of this study was reported to the local health authority, local goverment of the city and to the Ministry of Health to attract their attention to tuberculosis control programs, especially in schools, dormitories, day-care centers and military services.

This study is important in the sense that it constitutes an example and reminder as to how fastidiously we must work on index cases and their environment to prevent the spread of tuberculosis.

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