ORIGINAL ARTICLE

STUDY OF TRANSMISSION OF TUBERCULOUS INFECTION AMONG CHILDREN IN CONTACT WITH PARENTS HAVING TUBERCULOSIS

Hiral H Shah[1], Halak J Vasavada[1], Bijal S Shah[2], Deepa A Banker[3], Kinnari Vala[4]

Author's Affiliations: [1]Assitant Professor; [2]Associate professor; [3]Professor; [4]Senior Resident, Department of Paediatrics, Sheth V S General Hospital, Ahmedabad
Correspondence: Dr. Hiral H. Shah, Email: drhiralgopani79@yahoo.com

ABSTRACT

Introduction: The goal of tuberculosis (TB) control programs is to eliminate the disease by breaking the chain of transmission. Since open cases are rarely present in children, it is imperative that along with the treatment of adults, children coming in contact with the adults be screened simultaneously. This study was done know occurrence of TB infection among children in household contacts with parents having tuberculosis & identify the possible risk factors.

Methods: 300 children under the age of 15 years who were in household contact with parents on anti tubercular treatment underwent tuberculin skin testing and ESR estimation. Transverse indurations of greater than 10 mm and ESR>40mm/hr were suggestive of tubercular infection. Risk factors such as age, nutritional status, SE status, BCG vaccination and anemia were studied.

Results: 90(30%) out of 300 children were positive for the infection. The risk of transmission of infection is significantly higher if both the parents are affected (50%). The important risk factors for infection transmission were younger age, severe malnutrition, lower socio-economic status, absence of BCG vaccination and anemia (P value <0.05).

Conclusion: The prevalence of tuberculosis infection among children in household contact with parents is higher than in the general population. Novel approaches for child contact screening and management that improves the implementation of the same needs to be further evaluated in national programmes.

Key words: Contact, Tuberculosis, Parents, Infection

INTRODUCTION

Tuberculosis has been with mankind as a major health hazard since long. Proximity and persistence of contact are major determinants of the risk of transmission of infection, and those living within the same household are at higher risk than casual contacts.[1,2] Among household contacts, those who are very young and those with absolute or relative immunodeficiency states are at increased risk of acquiring infection.Estimating the burden of TB in children is challenging for several reasons as there is No standard case definition exists, Limited resources prohibit the establishment of a confirmed diagnostic criteria, Lower public health priority as compared to the adult disease.[3]Children in contact with adult patients are at highest risk of getting infected, and hence contact screening is important for early detection of transmission of infection.[4,5,6] This is of great value not only to detect infected individuals but for the community as a whole, because a child with tuberculosis represents recent and ongoing transmission of infection within the community. The goal of tuberculosis control programmes is to eliminate the disease by breaking the chain of transmission, which can be effectively achieved by rapid identification and effective treatment of infectious cases.[4,7,8] Once these cases are detected, it is imperative to detect infected children in contact with them so that the chain of transmission can be broken.

Present study was done to identify the risk of transmission in children with parents having tuberculosis and also evaluate risk factors in children for need to implement contact screening in routine practice.

OBJECTIVES

The main objective of the study is to study the occurrence of TB in children with parents taking antituberculous treatment (ATT), to study the risk of transmission of infection and disease from either of the parents to the children and to study the risk factors in children in contact with TB positive parents

MATERIALS AND METHODS:

This was an observational prospective study done between January 2012 to January 2013 in a tertiary care hospital and in community. All the Children under the age of 15 years who were in household contacts of parents with TB taking ATT were included in study. Total 300 children were included. Children with concurrent conditions identified as risk factors for tuberculosis (HIV infection, immunosuppressive therapy, haematological disorders or malignancies) were excluded from

the study. Children not living in the same house as adult patients were excluded from the study.

The study was initiated with the approval of the institutional ethics committee and written informed consent of either parent was taken for inclusion of children.Detailed history and examination was done according to the standard protocol. Routine investigations including complete haemogram with ESR and MT 0.1 ml ID (10 tuberculin unit) was done in all children. Indurations >10 mm on tuberculin testing and ESR>40 mm were taken as positive results and children were considered to be suffering from TB infection.

History of BCG vaccination was especially enquired after, and scars examined. Malnutrition (1-5 yrs) classified according to the Indian Academy of Paediatrics (IAP) classification: grade 1, weight 71–80% of expected; grade 2, weight 61–70% of expected; grade 3, weight 51–60% of expected; and grade 4, weight less than 50% of expected.[9] Grades 2, 3 and 4 were considered to be undernourished. Children (5-15 yrs) were classified according to BMI (Body mass index). BMI <15 were taken as undernourished.[9] Hemoglobin (Hb) levels <11 were considered to be anemic.[10] Modified Prasad classification based on the per capita income per month was used to classify the SE status of children where classes I&II were taken as higher and rest were taken as lower classes.[11] Height was measured using a stadiometer and weight was recorded using a single precalibrated beam balance. ESR and MT were done. Indurations >10 mm on tuberculin testing and ESR>40 mm were taken as positive results and children were considered to be suffering from TB infection.[12]

Modified Prasad Socio economic Class	Per Capita income per month (Rs)
I	>5200
II	2600-5199
III	1560-2599
IV	780-1559
V	<780

Infected children underwent chest radiography, analysis of gastric lavage fluid or induced sputum and CSF routine micro as per requirement for confirmation of the diagnosis. Those children with the evidence of disease or infection were referred to RNTCP centre for further management. Out of 600 adult patients taking ATT, 340 had children as household contacts of which 300 were studied and analyzed.

RESULTS

Out of 600 adult patients taking ATT, 340 had children had household contacts of which 300 were studied and analyzed. Of these 170 were males and 130 were females,180 was in the 1-5 yrs age group.

Table 1: Status of children in contact with parents having TB

Parent with history of TB	Children (n=300)	Children with disease or infection (n=90)
One parent	240	60 (48.42%)
Both	60	30 (50%)

P value <0.01; Odds ratio 3.00 (95% CI 1.61-5.61)

Thus in our study, children with both partents affected with tuberculosis had 3 times more chances of developing tuberculosis compared to children with only one parent-father/mother affected with tuberculosis.

Table 2: Various factors and their association with development of Tuberculosis in children

Risk factors	Total (n=300)	Children with infection (n=90) (%)	Odds Ratio	95% CI*	P value#
Age Group					
1 – 5 yrs	170	72 (42.3%)	4.57	2.46-8.56	<0.01
≥5 yrs	130	18 (13.84%)	1		
SE Status					
Lower	260	85 (32.6%)	3.4	1.22-10.26	<0.01
Higher	40	5 (12.5%)	1		
Nutritional Status					
Under Nutritious	220	72 (32.72%)	1.68	0.89-3.18	0.08
Normal	80	18 (22.5%)	1		
BCG Status					
Unvaccinated	112	52 (46.42%)	3.42	1.98-5.92	<0.01
Vaccinated	188	38 (20.21%)	1		
Anemia					
Anemic	208	75 (36.1%)	2.89	1.50-5.66	<0.01
Normal	92	15 (16.30)	1		

Thus, age 1-5 years, low socio economic status, under nutrition, BCG non vaccination and anemia are associated with significantly higher risk of developing tuberculosis in children with parents having tuberculosis.

DISCUSSION

Although great progress has been made in diagnostic methods for tuberculosis, screening tests to identify contacts is still lacking. Routine screening of children who are in household contact with tuberculous parents is universally recommended but rarely implemented in our setting.[4,6] Cross-sectional study in India reported that only 31 of 220 (14%)[2,8.] children younger than 14 years living in the same house as adults with pulmonary TB were screened for TB. Screening tests for child contacts of TB patients rely on tuberculin test. One of the great limitations is that it depends on operator training and experience for correct administration and interpretation. However, in this study a single trained experienced technician performed the test. But operator bias

cannot be completely ruled out. Another limitation of the study is that children of parents having TB taking AKT were included irrespective of primary nature, severity of infection and category of treatment.

Bacteriological confirmation was not achieved in all cases as according to Starke, positive TSTs, abnormal radiographs and history of contact forms the triad responsible for diagnosis of most TB cases in children.

This study aims to study occurrence of TB infection among child contacts with tuberculous parents. Total 300 children were screened out of which 90(30%) children were tuberculous positive, which was higher than the prevalence of TB (3-5.5%). One study in South Africa reported a prevalence of 24-69% among household child contacts which was much higher than the active TB infection.[13] In the study by SChaff HS et al, 54% children had household members identified as TB with 29% having same strain as the child on RFLP. [14,15]

We have observed that chances of acquiring infection are more likely when both of the parents were affected (50%) as compared to when either of them (22-28%) was affected. Still chance of acquiring infections was significantly higher when single of both parents are affected by tuberculous infection. Similar study in Vietnam has shown that risk of tuberculosis in children is more with affected parents ($p<0.0001$, 95% CI 2.886-21.696) [16]. A Brazilian study has shown that mother and father are equally frequent sources of infection.

The chances of acquiring infection are more likely with lower age groups, as similar to other studies. Low income also leads to more chances of transmission. This is corroborated by another study showing 95%CI 1.598-7.779, $p=0.002$.[16]

Malnutrition seems to play a dual role with respect to tuberculosis. On the one hand, infection itself can result in failure to thrive and a malnourished state.[8] On the other hand, hypersensitivity to tuberculin testing may be depressed in malnourished children, interfering with accurate interpretation of the test and resulting in false negative reports.[14,15] however we found that all children < 5 years of age with under nutrition were at greater risk of developing tuberculosis. This is similar to studies in Brazil[14] showing 26.9% prevalence of malnutrition in affected children and in South African study.[13]

Chances of transmission also increase in BCG unvaccinated children underlining the protective effect of vaccination. We observed that 46.42% of BCG unvaccinated children were affected by tuberculous infection. Thus vaccination does have significant protective role in prevention of disease occurrence especially in healthy child [17,18]. It is emphasized that BCG vaccination cannot prevent natural tuberculous infection of the lungs and its local complications; although it reduces the haematogenous complications of primary infection.[19v]One study in Boston showed BCG vaccine protectivity average 50%.[20] We have observed that anemic children were at greater risk of acquiring infection.

CONCLUSION

Children are at a higher risk of contacting TB infection when either or both of the parents are infected. Children in the lower age group (1-5yrs) and lower SE status are more susceptible. BCG unvaccinated, undernourished and anemic children are more prone to develop infection. Contact tracing of all children having tuberculous positive parents is strongly recommended in routine practice.

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