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Original Research

Examining the possibility of tuberculosis in home connections among children

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ABSTRACT:

Background: One of the leading causes of mortality and morbidity in children is tuberculosis (TB). Children who live in the homes of adults who have tuberculosis are more vulnerable to infection and illness; one of the best ways to identify children who have TB is to do household contact investigations. **Aims and Objective**: The goal of the current research was to determine the prevalence and contributing variables of tubercular infection in children (ages 0–12) who live with newly diagnosed TB patients. **Materials and Methods**: From March 2021 to September 2022, a study was conducted in the pediatric department of a tertiary care facility on 254 children who had home contact. Along with a thorough clinical history and examination, baseline investigations were conducted to gather information on all household contacts aged 0–12, including sputum acid-fast bacillus, tuberculin skin tests, chest X-rays, and CBNAAT. **Results:** Of the moms, the majority had completed elementary school (54.7%), 21% had completed high school, and another 22% had graduated (p=0.921). Of them, 60% were workers, just 27.8% were company owners, and 14.7% had private employment (p=0.488). **Conclusion:** Children living with adult patients are more likely than the general community to get tuberculosis and develop clinical symptoms. that coming into touch with individuals who have sputum raises the danger considerably.

Keywords: NTEP, household contacts, contact tracing, and pediatric tuberculosis

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INTRODUCTION

One of the leading causes of mortality and morbidity in children is tuberculosis (TB). WHO TB statistics for 2019 show that there were 10.0 million TB cases globally, with around 10% (1 million) of the cases occurring in those under the age of 15 (1). Childhood TB is defined by the World Health Organization (WHO) as Mycobacterium tuberculosis infection in children ages 0–14. Aerosol droplets carrying bacilli expectorated by an active TB patient are inhaled and cause smear-positive pulmonary tuberculosis. Children who live with TB patients are thus at a higher risk of contracting the disease (2). According to TB contact tracing programs, a household contact is "a person or group of people, related or unrelated to each other, who live together in the same living unit and share a similar source of food" (3). Serious TB infections, including tuberculous meningitis, which may be fatal or have long-term effects (like neurological abnormalities), are more common in younger children. These young children might have had decades of productive lives ahead of them if not for these tragedies and their long-term effects on families and society (4). To reduce the burden of pediatric TB illness and mortality, more children with the disease must be identified, treated, or shielded from contracting it in the first place. In settings with limited resources, where it might be difficult to diagnose TB in children, preventing instances of the disease is particularly important (4). Household contact investigations are one of the best methods for identifying children with TB infection and illness because children who live in the households of adults with the disease are at a higher risk of contracting the disease (5). The prevalence of TB infection among pediatric age groups that have intimate interaction with a newly diagnosed tuberculosis patient has not been thoroughly studied till now. In order to ascertain the incidence of TB infection in the pediatric age range among household contacts of a newly diagnosed

tuberculosis patient, the present investigation was conducted.

MATERIALS AND METHODS

In the central Indian tertiary care hospital, a prospective cross-sectional research was conducted on 274 children with household contact of TB.

An person who had lived in the home for at least seven days in a row during the three months before to the TB diagnosis in the index case in the pediatric age range 0–12 years was considered a household contact for the purposes of this research. Contacts from the household who were already receiving anti-tubercular therapy (ATT) and had a TB infection or sickness were not included.

Before the research started, the parents or guardians of the patients gave their informed written approval. Sputum smear-positive pulmonary TB patients with one or more household contacts living with them were recruited for the research. The specified completed proforma was filled out with demographic information and other facts. Every youngster had a physical checkup and a thorough clinical history obtained. To rule out active TB in all household contacts aged 0–12, baseline tests such as skin testing for tuberculin, sputum AFB (Acid Fast Bacilli), chest X-rays, and CBNAAT (Cartridge based Nucleic Acid Amplification Test) were conducted.

Contacts in the household were questioned for any history of weight loss of 5% or no weight gain in the previous three months, an ongoing cough for more than two weeks, or a persistent fever lasting more than two weeks.

Every youngster had a chest radiograph taken as part of the first screening procedure. Military pattern, chronic fibrocavitary lesions, and hilar/paratracheal lymph nodes are among the lesions that are most indicative of tuberculosis.

To find out whether Mycobacterium TB was present, the kids were then placed through NTEP (Nation TB Elimination Program)-approved fast molecular tests, such as nucleic acid amplification tests (NAAT), on sputum samples or stomach aspirate specimens. This included collecting 2–5 milliliters of self-expectorated sputum in a sterile container and testing it for tuberculosis. After 4-6 hours of fasting, 10-15 ml of stomach aspirate was retrieved via a nasogastric tube in young infants who were unable to generate sputum.

The gold standard for diagnosing tuberculosis is the presence of Acid Fast Bacillus (AFB) on smear microscopy, in culture, or by molecular testing. According to the National Tuberculosis Elimination Programme (2022), a child who tested positive for NAAT was treated as having microbiologically proven TB and began receiving anti-tubercular treatment (ATT).(6)

STATISTICAL ANALYSIS

Microsoft Excel was used to record the data, and SPSS software for Windows, version 25 (SPSS, Chicago, Illinois), was used to conduct statistical analysis. Both percentages and absolute figures were used to display the data. To determine the association between several factors and a child's TB status, cross-tabulation was done. Fisher's exact test or the chi-square test were used to assess categorical variables. The threshold for statistical significance was set at $P<0.05$.

RESULTS

A total of 274 pediatric patients, ages 0 to 12, who lived with 108 newly diagnosed TB index cases, were the subjects of the current research. The research was carried out in the pediatric department of a medical college, as well as a local DOTS center and TB hospital.

Within the household contacts with tuberculosis, the incidence of pediatric tuberculosis was 6.8% (n=15 out of 274). According to the Mantoux test, the infection incidence was 20.9%. Among the children with TB, the majority were older (10.32±3.45 years; p=0.035), female (54.34%) compared to male (47.6%; p=0.349), and from an urban region (74.1) as opposed to a rural one (27.5%; p=0.286). (Table 1)

Of the moms, the majority had completed elementary school (54.7%), 21% had completed high school, and another 22% had graduated (p=0.921). Of them, 60% were workers, just 27.8% were company owners, and 14.7% had private employment (p=0.488).

Reduced appetite (67.1%) and weight loss (62%), followed by fever (54.1%) and cough (54.8%), were the most frequent presenting problems. Abdominal discomfort (15.1%), chest pain (15.1%), and neck lymph node edema (7.4%) were the other least frequent presenting symptoms. A p-value of less than 0.001 indicated that the distribution was significant.

Only two of the 15 TB-affected children's family members used LPG with wood as fuel, whereas the rest (87.4%) used LPG for cooking. With a p-value of 0.473, the distribution was not statistically significant.

The majority of vaccinations were finished for age (67.4%), whereas just some (34.2%) were finished. The p-value of 0.007 indicated that the distribution was significant. 87.1% of families with children who had tuberculosis had more than four members. With a p-value of 0.084, the distribution was not statistically significant. Isoniazid prophylaxis was administered to the majority of the TB-affected youngsters. A p-value of less than 0.001 indicated that the distribution was significant. (Table 2)

The majority of children with a TB diagnosis had pulmonary TB (60 percent; p=0.009) and were female (67.4%; p=0.076). Eighty percent of the TB-affected youngsters finished their therapy.

Table 1: Characteristics of study subjects in household contact with tuberculosis

Parameters		TB Disease		Total	P value
		No	Yes		
Sex	Female	108 (39.4)	15 (60)	123 (44.8)	0.076
	Male	141 (51.4)	10 (40)	151 (55.1)	
Type of TB	Extra Pulmonary	80 (29.1)	11 (44)	91 (33.2)	0.009
	Pulmonary	169 (61.6)	14 (56)	183 (66.7)	
Sputum status of parent	Negative	170 (62.0)	13 (52)	183 (66.7)	0.208
	Positive	79 (28.8)	12 (48)	91 (33.2)	

Table 2: Comparing significant parameters associated with the TB disease

Parameters		TB Disease		Total	P value
		No	Yes		
Mantoux Test	Non-Reactive	201 (73.3)	0 (0)	211 (77.0)	<0.001
	Reactive	38 (13.8)	25 (100)	63 (22.9)	
Sputum for AFB test	Negative	211 (77.0)	10 (40)	221 (80.6)	
	Positive	0 (0)	15 (60)	15 (5.4)	<0.001
	Not Done	38 (13.8)	0 (0)	38 (13.8)	
Chest X-Ray	Not Done	98 (35.7)	0 (0)	99 (36.1)	
	Not Suggestive	146 (53.2)	7 (28)	158 (57.6)	<0.001
	Suggestive	0 (0)	18 (72)	18 (5.1)	
CB NAAT	Not done	229 (83.5)	15 (60)	244 (89.0)	<0.001
	Negative	20 (7.2)	8 (32)	28 (10.2)	
	Positive	0 (0)	2 (8)	2 (0.8)	
BCG Scar	Absent	17 (6.2)	12 (46.7)	29 (10.5)	<0.001
	Present	232 (84.6)	13 (53.3)	245 (92.5)	
Malnourishment	No	232 (84.6)	5 (20)	238 (89.4)	<0.001
	Yes	17 (6.2)	19 (76)	36 (10.2)	
Smokers in family	No	171 (62.4)	11 (44)	182 (66.4)	0.018
	Yes	78 (28.4)	14 (56)	92 (33.5)	
HIV Positive	No	249 (90.8)	18 (72)	267 (97.4)	<0.001
	Yes	0 (0)	7 (28)	7 (2.5)	
Vaccination	Completed	221 (80.6)	15 (60)	236 (86.1)	
	Partially completed	25 (9.1)	10 (40)	35 (12.7)	0.008
	Not Done	3 (1.0)	0 (0)	3 (1.0)	
Isoniazid prophylaxis	Not given	182 (66.4)	13 (52)	190 (69.3)	<0.001
	Given	67 (24.4)	17 (68)	84 (39.6)	

DISCUSSION

Because it is a symptom of recent TB transmission, TB illness in children under the age of 15—also known as pediatric tuberculosis—is a public health issue of particular importance. (7) Of particular importance, babies and young children are more susceptible to developing life-threatening types of tuberculosis illness (e.g., disseminated TB, TB meningitis) than older children and adults. Children under the age of five and teenagers over the age of ten account for the majority of pediatric TB cases. (7) The majority of the time, persons with pulmonary illness spread the virus via the air. The bacillary density in respiratory secretions is directly correlated with the probability of transmission, which is higher if the index case is "sputum smear positive." As a result, the probability of virus transmission is mostly determined by the closeness and duration of contact, and household members are more vulnerable than other contacts.

A total of 254 pediatric patients who lived with 103 newly diagnosed TB index cases were the subjects of the current investigation. 15 (5.9%) of the 254 pediatric patients had tuberculosis. 5.9% of the pediatric patients in the current study center had TB illness. Compared to children without the condition, children with TB were considerably older (9.33±2.46 years) with a p-value of 0.034.

The current research found that the incidence of infection and tuberculosis in children was 20.9% and 5.9%, respectively. A significant incidence of TB infection and sickness (45 percent and 23 percent, respectively) was observed. in their study of 195 children aged 5 and above who were contacts of 161 source cases. (8) in a study of 761 kid contacts who were 15 years old revealed that children had a higher prevalence of TB (10%). (9) The majority of TB-affected children were young, female, and from metropolitan regions. According to similar study, which examined 200 consecutive adults with pulmonary tuberculosis in their homes, exposure to tobacco smoke in the environment, severe

malnutrition, contact with an adult who had sputum-positive status, and younger age were all important risk factors for infection transmission. These findings are consistent with those of the current study. (10) A study in South East Asia that included 11 heterogeneity studies and found that the prevalence of tuberculosis disease ranged from 3.3% to 5.5%, while the frequency of tuberculosis infection was higher among child contacts under the age of 15 (24.4–69.2%). (11)

According to a study., who assessed the factors associated with tuberculosis transmission and determined the prevalence of TB infection among children under five who lived with pulmonary tuberculosis patients, the Mantoux test was positive in 13.7% of 190 home contacts. This is consistent with the finding that all children with TB had positive results. (12)

According to a research 99% of patients who started isoniazid therapy did not develop disseminated TB. (9) Accordingly, isoniazid prophylaxis was administered to almost all child TB patients in the current investigation. According to Martinez et al., 85% of children with a positive infection test and 63% of all exposed children benefited from preventative treatment. (13)

HIV status, malnourishment, family smoking, and a positive tuberculin skin test at baseline were risk factors. Accordingly, a study conducted in the Lucknow district of Uttar Pradesh, which involved 200 family children aged 1 to 15, of sputum-positive patients who were registered at DOTS clinics, found that malnutrition, length of stay with index case, and age greater than 6 years were all associated with tuberculosis infection in children. (14)

According to reports by Martinez et al., the likelihood of TB among infected children who did not get prophylactic treatment was 19.0% among children aged 0 to 5 (n=137,647) exposed. (13)

The majority of the index source patients with a TB diagnosis were female and had pulmonary TB. According to a study who examined 195 children aged 5 and older who were contacts of 161 source cases, the probability of a child contracting an infection rose sharply with the source case's smear-positivity and if the source case was female. (8) Pulmonary illness affected 73.6% of the population, and the majority of the children had a female source case (66.1%). (15) This shows that childhood illness was associated with adult index variables such as sex, HIV status, and the degree or severity of the disease.

CONCLUSION

Children living with adult patients are more likely than the general community to get tuberculosis and develop clinical symptoms. that coming into touch with individuals who have sputum raises the danger considerably. Given that women contribute significantly to the spread of the illness and that female children are more susceptible than male children, TB control programs should have a stronger emphasis on females. The main risk factors for the infection include HIV status, malnutrition, family members who smoke, and a history of positive tuberculin skin tests. The BCG vaccine is quite protective, particularly for kids under five. There are a number of variables that may be regulated to prevent tuberculosis infection in children, including the environment, susceptible host, and index case. One crucial component of tuberculosis preventive therapy that will aid in the eradication of tuberculosis in India is contact tracing in the community.

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