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CONTACT SCREENING AND YIELD OF TUBERCULOSIS FROM PEDIATRIC TB INDEX CASES

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Abstract

BACKGROUND: Contact tracing helps in identifying new Tuberculosis (TB) cases in house hold contacts and thus interrupting the transmission. Our Objective was to determine the proportion of paediatric TB cases started on Anti Tuberculosis Treatment (ATT) under NTEP in Madurai district and to screen and estimate the prevalence of Latent TB Infection (LTBI), active TB disease among the household contacts of paediatric TB index cases.

METHODS: A prospective cross sectional study was conducted where 108 household contacts (HHC) of 37 paediatric TB cases were evaluated for any symptoms suggestive of TB and screened for TB using chest X-ray, mantoux test, sputum AFB. To determine the factors associated with active TB, Pearson's Chi-square test/Fisher's exact test was performed.

RESULTS: A total of 108 HHC with mean age of 28.6 years were screened. Six of them had previous history of ATT, Mantoux was positive in 10 of them. Chest X-Ray was abnormal in 8 of them. 2(1.9%) HHC were diagnosed on basis of Chest X-Ray changes while 1(0.9%) was diagnosed based on clinical features .2.8% HHC were diagnosed as new TB cases among adults and children

CONCLUSION: This was one of the few studies in India that evaluated the yield of contact investigation from Paediatric TB Index cases and indicates the possibility of contact investigation and the possible contribution towards the national objective of early and improved TB case detection.

KEYWORDS : Contact tracing, Humans, Pediatric, tuberculosis

INTRODUCTION

Breaking the cycle of tuberculosis (TB) infection requires both treatment and prevention. Contact tracing helps in identifying new TB cases in house hold contacts and thus interrupting the transmission.

An estimated 10 lakh children became ill with TB and 2,50,000 children died of TB in 2017 (including children with HIV associated TB) (1). In 2017, Paediatric TB cases accounted for 6% of the total TB burden due to under diagnosis, while the actual paediatric burden is closer to 8%. About 2,24,000 incident cases of paediatric TB are estimated to occur every year accounting for 22% of global burden. In 2018, a total of 1,32,711 paediatric TB patients (only 59% of estimated) were notified in India, which included new and relapse paediatric TB patients.[1] However, because the majority of children are sputum microscopy smear negative, these data underestimate the true burden of childhood TB.

Contact investigation has been recommended internationally as a promising approach for identifying persons at high risk for developing tuberculosis (TB) and offers an opportunity for early case detection.[2,3] However, in many low-resource, high-TB burden countries, contact investigation is not often conducted despite national policy.[4,5]

NTEP has recommended the contact tracing of sputum smear positive adult TB cases.[6] Children, who are less infectious due to paucibacillary disease, most often contract TB from infectious adult household contacts with active TB.[7] Diagnosing a paediatric TB case therefore strongly suggests the presence of an untreated TB case at home. Kubaisy et al.[8] reported a case yield of 17.4% among contacts of children with latent tuberculous infection in Iraq; Eckhoff [9] reported a case yield of 8.3% among contacts of paediatric index cases in Haiti; however, on excluding those with known TB, the yield dropped to 1.8%.

No study has yet examined the yield of contact tracing using paediatric index cases in our setting. So we had conducted a study to describe the case yield of TB contact tracing using paediatric index cases in Madurai district, Tamilnadu.

Our Objective was to screen and estimate the prevalence of LTBI, active TB disease among the household contacts of

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paediatric TB index cases upon determining the proportion of paediatric TB cases started on ATT under NTEP in Madurai district.

METHODOLOGY

STUDY DESIGN AND STUDY SETTING : A cross sectional study was conducted in the NTEP centres located in Madurai district during the period July 2019 to December 2019 where children ≤ 14 years were registered and started on TB treatment.

STUDY POPULATION : Our Study population included the Household contacts of Paediatric TB cases (aged 0-14 yrs) started on ATT in the NTEP centers in Madurai district over a period of 6 months.

CASE DEFINITION : An Index TB case in our study was defined as the children aged ≤ 14 years who were registered for TB treatment at the NTEP centres.

Household contact (HHC) was defined as a person living with and sharing food from the same kitchen as the index patient for a minimum of three months prior to diagnosis of TB disease of the index case. An index case at these centers are diagnosed as having TB by considering suggestive clinical features, the history of TB contact, positive TST (≥ 10mm was considered positive), and evidence of TB in chest X-ray (CXR), sputum microscopy (mostly children greater than 7 years) for pulmonary TB (PTB). For diagnosis of EPTB at these centres, diagnostic tests were performed depending on the sites involved.

STUDY PROCEDURES : The study was approved by our NIRT Ethics Committee. After necessary ethical approval, the NTEP staffs of Madurai district were trained on study related procedures before the study initiation. Index case details were obtained both from the patient (demographic details, personal habits) and the NTEP treatment card (method of diagnosis and type of TB). Their HHC were registered at the study sites and their demographic details were noted after written informed consent. Written informed consent was obtained for HHCs aged > 18 years. Parent / guardian consent was obtained for HHCs aged <18 years. Assent was obtained from children aged >7 years. HHCs were evaluated for any symptoms suggestive of TB (cough ≥ 2 weeks, fever and weight loss) and screened for TB using a CXR and Mantoux testing. A spot sputum specimen was collected for those who were symptomatic for AFB smear examination.

STATISTICAL ANALYSIS : All data were entered in Excel 2010 and statistical analysis was performed using the statistical software SPSS 25.0. Data were described as frequency (with percentages), mean values (with standard deviations) and median (with IQR). To determine the factors associated with active TB, Pearson's Chi-square test/Fisher's exact test was performed. Results were defined as statistically significant when the P value (2-sided) was less than 0.05.

RESULTS

INDEX CASES: Out of 52 index cases, the household contacts of thirty seven Index cases were willing to participate in the study and were registered. Table 1 shows the demographic and clinical characteristics of the Paediatric Index cases. The median age of the Index cases was 9 and most of them were females (62.2%) and with primary level education. Exposure to biogas fuel was minimal (13.9%). Four of them had previous history of ATT. Sputum examination was done for 13 of them and Mycobacterium Tuberculosis (M.Tb) was detected in 6 of them (46.2%). Chest X ray abnormality was detected in 13 (44.8%) with infiltrations being the major findings. Sputum positivity and CXR abnormality was found in 4 of the Index cases. Extra pulmonary investigations done included Ultrasound, MRI, and CT scan of the concerned site, biopsy and FNAC of the sample for AFB detection. Final diagnosis of the index cases were pulmonary TB in 18 and extra pulmonary TB in 18 of the total index cases. Lymph node TB (33.3%) was the most common extra pulmonary TB in these cohorts. One of these index case was HIV positive.

HOUSEHOLD CONTACTS : There was a median 4 household contacts for these index paediatric cases. Table 2 shows the demographic and clinical characteristics of the household contacts of Paediatric Index cases. There was a total of 108 household contacts with a mean age of 28.6 years. They were mostly females (52.8%) and with primary school education level (26.3%). Of these eighteen contacts had either of the chest symptoms suspicious of TB with cough being the predominant one in 94.4% of them but their sputum smear was negative. Six of the household contacts had history of previous ATT intake and seven had co-morbid conditions such as Diabetes, hypertension and others. Smoking history was present in 4 of these contacts (3.7%). Mantoux was positive in 10 and Chest x-ray was abnormal in 8 of them. Seven of the household contacts had Mantoux positive without any symptoms and with normal Chest X ray. During screening, 2 (1.9%) HHC were diagnosed on the basis of CXR changes and TST positivity, while 1 (0.9%) was diagnosed on the basis of clinical features and seven were diagnosed as TB infected. None of the TB symptom status, Mantoux positivity or abnormal CXR of the household contacts was found associated with TB in Index cases (Table 3 and Table 4).

Table 1: Demographic and clinical characteristics of paediatric TB index cases

Index cases	
	n (%)
Total	37
Female sex	23 (62.2)
Age, years, median [IQR]	9 (5.5 – 10.5)
Range	1 – 14
Age ≤5 years	9 (24.3)
Educational Status	
Not attending the School	5 (13.5)
Palvadi	2 (5.4)
Primary School	21 (56.8)
Upper Primary School	6 (16.2)
Secondary School	3 (8.1)
Type of Indoor heating/cooking fuel	
Gas	31 (86.1)
Wood	5 (13.9)
Type of family	
Nuclear	29 (78.4)
Joint	8 (21.6)
Previous H/O of ATT	
Yes	4 (10.8)
No	33 (89.2)
Sputum Result	
MTB detected	6 (46.2)
MTB not detected	7 (53.8)
CXR	
Normal	16 (55.2)
Abnormal	13 (44.8)
Diagnosis	
PTB	18 (50.0)
EPTB	18 (50.0)
HIV status	
Positive	1 (3.3)
Negative	29 (96.7)
ATT Regimen	
CAT I	35 (94.6)
CAT II	2 (5.4)
Number of household contacts, median [IQR]	4 (4 – 5)

Table 2 : Demographic and clinical characteristics of household contacts of paediatric TB index cases

	Household contacts n (%)	Asymptomatic contacts n (%)	Symptomatic contacts n (%)
Total	108	90	18
Female sex	57 (52.8)	49 (54.4)	8 (44.4)
Age, years, mean ± SD	28.6 ± 17.5	29.1 ± 17.9	26.1 ± 15.1
Range	2, 72	3, 72	2, 52
Age ≤5 years	7 (6.5)	5 (5.5)	2 (11.1)
Educational Status			
Palvadi	3 (3.2)	2 (2.6)	1 (5.9)
Pre-Primary	4 (4.2)	2 (2.6)	2 (11.8)
Primary School	25 (26.3)	23 (29.5)	2 (11.8)
Upper Primary School	17 (17.9)	15 (19.2)	2 (11.8)
Secondary School	21 (22.1)	16 (20.5)	5 (29.4)
Higher Secondary School	14 (14.7)	12 (15.4)	2 (11.8)
Diploma	3 (3.2)	3 (3.8)	-
Graduate/Postgraduate	8 (8.4)	5 (6.4)	3 (17.6)
Symptoms present			
Cough	17 (15.7)	-	17 (94.4)
Fever	1 (0.9)	-	1 (5.6)
Weight loss	1 (0.9)	-	1 (5.6)
Loss of appetite	3 (2.8)	-	3 (16.7)
Previous History of ATT	6 (5.6)	4 (4.4)	2 (11.1)
Co-morbid conditions	7 (6.5)	5 (5.5)	2 (11.1)
H/O Alcohol Intake	10 (9.3)	7 (7.8)	3 (16.7)
H/O Smoking	4 (3.7)	4 (4.4)	-
Mantoux (≥10 mm)	10/107 (9.3)	9/89 (10.1)	1/18 (5.6)
Abnormal CXR Finding	8/104 (7.7)	5/88 (5.7)	3/16 (18.8)

Table 3 : Association between the sputum status of Index cases with Household contacts Characteristics

	Sputum Results of Index Case			
	MTB Detected n (%)	MTB Not Detected n (%)	Total n (%)	P-value
Symptom Diagnosis				
Asymptomatic	15 (100.0)	75 (80.6)	90 (83.3)	0.070
Symptomatic	-	18 (19.4)	18 (16.7)	
X-ray Findings				
Normal	13 (86.7)	83 (93.3)	96 (92.3)	0.325
Abnormal	2 (13.3)	6 (6.7)	8 (7.7)	
Mantoux-Reading (in mm)				
≥10	4 (26.7)	6 (6.5)	10 (9.3)	0.032
<10	11 (73.3)	86 (93.5)	97 (90.7)	

Table 4 : Association between the X-ray status of Index cases with Household contacts Characteristics

	X-ray findings of Index Case			
	CXR Normal n (%)	CXR Abnormal n (%)	Total n (%)	P-value
Symptom Diagnosis				
Asymptomatic	60 (81.1)	30 (88.2)	90 (83.3)	0.417
Symptomatic	14 (18.9)	4 (11.8)	18 (16.7)	
X-ray Findings				
Normal	64 (91.4)	32 (94.1)	96 (92.3)	1.000
Abnormal	6 (8.6)	2 (5.9)	8 (7.7)	
Mantoux-Reading (in mm)				
≥10	6 (8.2)	4 (11.8)	10 (9.3)	0.723
<10	67 (91.8)	30 (88.2)	97 (90.7)	

DISCUSSION

In the current study, 2.8% household contacts were diagnosed as new TB cases among adults and children. The secondary cases diagnosed presented with minimal disease. Two HHC adults (1.9%) was diagnosed as TB by chest X ray and Tuberculin skin test and 1 child contact (0.9%) diagnosed clinically. These disease states represent early TB disease with high risk of TB progression and are likely to contribute to continued transmission.[10] These results are comparable to recently published study from India.[11,12] Our results are in

agreement with the study from India where majority of the source cases were identified for adults.[13] In this study 37 index cases were taken, totally 108 HHC were screened, this proportions are low, this should be improved for best results. Typically, contact tracing is initiated after TB is confirmed in an index case—usually an adult with infectious TB. Tracing the contacts of a smear positive index adult case, such as household contacts is the usual screening technique in countries with high prevalence of tuberculosis and is an important strategy in the tuberculosis control programme. However, when the index case is a young child with suspected (rather than confirmed) tuberculosis, contact tracing (variously known as source case investigation, reverse contact tracing or ascending surveys.[8, 13-15] is reported on less frequently.

Screening of the targeted risk group is more practical and cost effective. In areas of high prevalence, tuberculosis carries a social stigma and a positive family history is often denied until pursued repeatedly. Similarly finding adult tuberculous contact source is an important way of diagnosing paediatric tuberculosis A source case investigation for children with TB disease in Pune, India also showed that opportunities for TB prevention and control were being missed because contact tracing is poorly implemented in India.[13]

In this study, proportions of HHC of TB children was very low, these numbers should be improved in future studies to get more accurate results. The limitations of our study was that the number of Index paediatric cases and their household contacts were low as the study was done only for a six months' time period and only six of these index patients were infectious cases, hence any statistical application could not be used to evaluate the significance of individual risk factors for transmission of disease. A minimum of 2 appointments needed to complete screening, transport and time costs for the patients and their families have all been identified as barriers to screening in our study also.[16] The symptomatic HHC were asked to give sputum sample on the spot for AFB smear examination and overnight specimens was not collected for them for improved TB case detection.[17,18]

HHC tracing is an important component to end TB in high prevalence areas. Through systematic and active case finding among household contacts, we found additional TB cases beyond passive contact screening (becoming symptomatic and later attending the clinic) which is an encouraging approach towards improving access to early diagnosis of TB. So, improving screening tools for TB will help to early detection in HHC contacts.

CONCLUSION

This was one of the few studies in India that evaluated the yield of contact investigation from paediatric index TB cases and indicates the possibility of contact investigation and the possible contribution towards the national objective of early and improved TB case detection. Larger-scale implementation is needed to determine the generalizability of the findings.

DECLARATIONS

- Ethics approval and consent to participate- The study was approved by our NIRT Ethics Committee and written informed consent was obtained from the participants
- Competing interests- The authors declare there are no competing interests
- Funding- The authors received no funding for the present study.
- Authors' contributions- Conceived and designed the experiments: PN, BV, MR. Performed the experiments: PN, PR, ZM, MR. Analyzed the data: PN, MR. Wrote the paper: PN, BV, MR. All the authors reviewed the draft.
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