

Prevalence of Pulmonary Tuberculosis among Household Contacts in Hyderabad, Sindh: Active Contact Tracing in Children with Tuberculosis

Munir Ahmed Sheikh,¹ Amir Iqbal Memon,² Imran Sarwar Shaikh,³ Bikha Ram Devrajani,⁴ Salma Shaikh,⁵ Sikander Munir Memon,⁶ Syed Arshad Ali Shah⁷

PHRC, Research Centre,¹ Department of Surgery,² Department of Medicine,^{3,4} Department of Paediatrics,⁵ Medical Research Centre,⁶ Liaquat University of Medical & Health Sciences, Jamshoro, Kotri Institute of Chest Diseases,⁷ Kotri, District Jamshoro.

Abstract

Background: Tuberculosis (TB) in children is clearly linked to TB in adults therefore active household contact tracing is an important method of early diagnosis and treatment particularly in high-TB-burden countries.

Objectives: To estimate the prevalence of TB among household contacts of children suffering from tuberculosis using active contact tracing and linking them to TB program for treatment.

Subjects and Methods: A total of 125 children suffering from active tuberculosis (index cases) aged 12 years or less were randomly selected from the outpatient department of a tertiary care hospital of Hyderabad. Using their home address, all household members of the index cases (sharing one kitchen) were identified. The households were visited by a team including a doctor and the supported staff and were screened for TB using history, physical examination, sputum for AFB and X-ray of chest. Clinical suspects were divided into two populations, equal to or less than 12 years of age and greater than this age. All suspected cases were brought to outpatient's department of the hospital where children were examined and diagnosed by pediatrician and adults were examined by the pulmonologist.

Results: There were 125 children and 1365 household members. Prevalence of active TB in adult household contacts was 8.1% and among children was 5.7%. Mother, father, grand parents or siblings were the source of disease spread in children. Family history of TB was present in 95% (pulmonary 78%, extra-pulmonary 22%).

Conclusion: Tuberculosis in children is mostly spreading from household member hence deeply required to undertake active contact tracing in each new case that is diagnosed or being treated.

Policy message: National and Provincial TB programs should advocate and undertake active screening of all household contacts of all TB cases.

Key words: Childhood tuberculosis, active contact tracing, prevalence of TB.

Introduction

Children with tuberculosis contribute substantially to the global burden of disease but these cases are rarely recorded with accuracy.¹ Almost 11% new TB

cases are children.² In low middle income countries 15-20% of all tuberculosis cases are due to childhood TB while this figure is 2-7% in high income countries.³⁻⁵

Childhood tuberculosis is increasing worldwide but this rate is faster in developing countries due to difficulties in making a diagnosis and in ability to confirm the diagnosis.⁶ Childhood tuberculosis is a neglected portion of TB epidemic and it is taken as contributing little in the spread of tuberculosis.^{4,7,8} There is no gold standard diagnostic test available for diagnosing tuberculosis in children either by means of microscopy, culture, PCR or serology.⁹⁻¹²

One of the major constraints in the control of tuberculosis and a low case detection rate in under developed countries is not practicing "TB contact tracing" which is a common practice in developed countries.¹² The detection of infectious adults and treating adult contacts of tubercular children is called ascending survey and investigating and treating children and adults

Corresponding Author:

Munir Ahmed Sheikh
PHRC, Research Centre
Liaquat University of Medical & Health Sciences
Jamshoro.
Email: ahmad5785@gmail.com

Received: 29 September 2016, **Accepted:** 27 February 2017,
Published: 20 March 2017

Authors Contribution

MAS and SS have done the conceptualization of project. Data collection was done by MAS and AIM. MAS and BRD did the literature search. MAS and SMM has participated in statistical analysis. Drafting, revision and manuscript writing were done by MAS, AIM, ISS and SAAS.

in contact with sputum positive or sputum negative cases through contact tracing in the adults is called descending survey.

Pakistan ranks at number 8th among 22 greater load tuberculosis countries in the world.¹³ Out of almost 32% of the world's population infected with the disease, 95% are residing in the developing countries and 98% of all TB related deaths occur in these regions.¹⁴ World Health Organization Stop TB Partnership had given two targets, reducing death and prevalence by 50% by the year 2015 and to eradicate TB as a public health problem by 2050.¹⁵

The incidence of TB is 231 per 100 000 and 420 000 new cases of TB occur every year in Pakistan as estimated by WHO.¹⁶⁻¹⁹ Contact investigation in this region therefore deserves a priority plan for early case detection and decrease disease transmission in high incidence countries. Studies have reported that contact investigation is valuable for identifying new TB cases.²⁰ Young children are more likely to develop active disease after contact with an active TB case when compared to adults and the risk decreases as the age advances.²¹

Child hood TB presents both as pulmonary and extra pulmonary TB and there is no gold standard diagnostic test available for diagnosing TB in children.²²⁻²⁴ Therefore physicians rely on the history, clinical tests, chest radiographs and tuberculin skin testing (TST). These approaches lack accuracy therefore, physicians either under or over diagnose the disease.¹⁹ Childhood tuberculosis is strongly associated with poverty.^{19,25-27}

A study on the operational issues of National TB control program concluded that "the public health care systems in Pakistan lacks the basic requirements for an effective TB control program that is a viable information system and the functional integration of the program with rest of the health care delivery system."²⁸

Objectives of this study were to quantify the prevalence of TB among household contacts of children suffering from tuberculosis using active contact tracing and to link active TB cases to DOTS regimen.

Subjects and Methods

This cross-sectional study was done using convenience sampling. Liaquat University of Medical and Health Sciences (LUMHS) is a tertiary care hospital where children diagnosed and being treated for TB were further studied. Their home address was pulled out from the record and a team of doctors and interviewers went to their homes. After taking informed consent all their household contacts (adults and children) were interviewed for symptoms of TB (using a questionnaire). The family members were also physically examined and investigated for the presence of TB.

Screening of adults was based on a history of cough for 02 weeks or more and low grade fever. The

suspects were asked for early morning sputum samples. Their chest x-ray was done at the radiology department of LUMHS and then reviewed by the Pulmonologist. Screening of children included a history of cough for over 02 weeks' duration, fever, weight loss, anorexia, lethargy and the lymph nodes enlargement. Clinically suspected children were brought to the pediatric department of LUMHS, for clinical examination, x-ray chest and sputum for AFB. The Pediatrician and the Pulmonologist examined them and referred the diagnosed cases to the TB program for management through DOTS.

Operational definitions were; Source case (Index case): Child with tuberculosis, smear positive, smear negative, or diagnosed on clinical suspicion, x-ray chest and scoring chart for TB screening by Pakistan Pediatric Association.

Close contact: Living in the same household sharing one kitchen as a source case (e.g. the child's care giver) or in a frequent contact with the source case.

Household contacts: The individuals living in the same household or spending together many hours a day with the index case in the same living shelter. Household contacts were defined as adults or children (12 years or less).

Information about household members was obtained from the parent/ guardian. Confidentiality of the participants was maintained.

Results

A total of 125 index children suffering from TB were enrolled from the outpatient department of a tertiary care, Liaquat University Hospital, Hyderabad. Screening of their 1365 household members was done at their respective homes. Majority of index cases belonged to the rural and urban slums of the city. There were 54% males and 46% females. Their mean age was 7.1 ± 4.2 years and their average family size was 11.2 ± 7.2 . History of contact with TB patient was present in 95% index cases (Figure). Amongst the index children, pulmonary TB was found in 78% and extra-pulmonary in 22%.

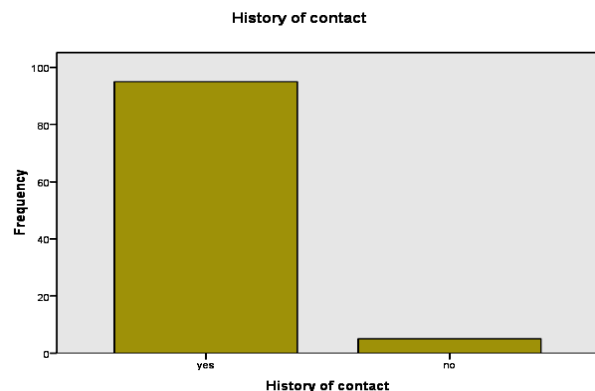


Figure: History of contact.

Prevalence of active TB in adult household contacts was 8.1% and amongst children (< 12 years of age) was 5.7%. First degree relatives like, mother, father, grand parents or siblings were the main source of infection to children (index cases).

Discussion

In the present study, amongst the household members of children suffering from TB, almost 8% adults and 5.7% children were suffering from active TB. Contact tracing for active pulmonary TB is a standard procedure for detecting and treating TB cases in developed countries.²⁹ One study conducted in a high incidence town in Lima, Peru having poor health indicators; showed TB prevalence of 0.91% (914 per 100 000) when active and passive contact investigation was done in the household contacts. Risk factors identified in this study were age > 55 years and female gender.³⁰ Many recent studies have also reported that active case finding in the household contacts detects greater number of TB cases than passive contact tracing.^{27,31,32} Therefore active case finding must be practiced among the high burden communities and countries.³³

One study from New Delhi, India reported 4.3% prevalence of active TB among household contacts, while from Iran 4.8% prevalence was reported.³⁴ The prevalence rate in England was 0.9% in 723 contacts while in Australia it was as low as 0.5% and in Japan 0.6%.³⁵ Studies conducted in high burden countries like Cameron and Malawi have shown the prevalence of TB among the household contacts as high as 14.6% and 64% respectively indicating that the prevalence of Tuberculosis among contacts depends upon the prevalence of that disease in the country.³⁶

Acknowledgement

We are highly grateful to PHRC for provision of funding and support. We are thankful to the Faculty of Pediatrics of LUMHS and Chest specialists of Kori Institute of Chest Diseases for allowing us to collect data and provision of diagnostic and management facilities to the index cases and clinical suspects of our study.

Conflict of interest: None declared.

References

1. Sandgren A, Hollo V, Quinten C, Manissero D., Childhood tuberculosis in the European Union/European Economic area, 2000 to 2009. *Euro Surveill* 2011;16(12):19825.
2. Marais BJ, Gie RP, Hesselning AC, Schaaf HS, Lombard C, Enarson DA,, et al. A refined symptom-based approach to diagnose pulmonary tuberculosis in children. *Pediatrics* 2006;118(5):e1350-9.

3. Marais BJ, Obihara CC, Warren RM, Schaaf HS, Gie RP, Donald PR. The burden of childhood tuberculosis: a public health perspective. *Int J Tuberc Lung Dis* 2005;9(12):1305-13.
4. Odhiambo JA, Borgdorff MW, Kiambih FM, Kibuga DK, Kwamanga DO, Ng'ang'a L, et al. Tuberculosis and the HIV epidemic: increasing annual risk of tuberculous infection in Kenya, 1986-1996. *Am J Public Health* 1999;89(7):1078-82.
5. Donald PR. Childhood tuberculosis: out of control? *Current opinion in Pulm Med* 2002;8(3):178-82.
6. Pandhi D, Reddy BS, Chowdhary S, Khurana N. Cutaneous tuberculosis in Indian children: the importance of screening for involvement of internal organs. *J Eur Acad Dermatol Venereol* 2004;18(5):546-51.
7. Organization, W.H., Guidance for national tuberculosis programmes on the management of tuberculosis in children. 2006. (Accessed on 10th March 2017) Available from URL: http://apps.who.int/iris/bitstream/10665/69389/1/WHO_HTM_TB_2006.371_eng.pdf
8. Van RA, Beyers N, Gie RP, Kunneke M, Zietsman L, Donald PR., Childhood tuberculosis in an urban population in South Africa: burden and risk factor. *Arch Dis Child* 1999;80(5):433-7.
9. Shingadia D, Novelli V. Diagnosis and treatment of tuberculosis in children. *Lancet Infect Dis* 2003;3(10):624-32.
10. Simonney N, Bourrillon A, Lagrange PH. Analysis of circulating immune complexes (CICs) in childhood tuberculosis: levels of specific antibodies to glycolipid antigens and relationship with serum antibodies. *Int J Tuberc Lung Dis* 2000;4(2):152-60.
11. Lagrange PH, Simonney N, Wagnier A, Herrmann JI. Usefulness of serological tests in childhood TB. *Pediatr Pulm* 2001;32(S23):61-4.
12. Dye C, Williams BG, Espinal MA, Ravigione MC. Erasing the world's slow stain: strategies to beat multidrug-resistant tuberculosis. *Science* 2002;295(5562):2042-6.
13. Vermund SH, Altaf A, Samo RN, Khanani R, Baloch N, Qadeer E, et al. Tuberculosis in Pakistan: A decade of progress, a future of challenge. *J Pak Med Assoc*, 2009;59(4):1-8.
14. Israr SM. Is Ministry of Health fully prepared to implement an effective DOTS program in Pakistan? An operations research on TB control program in the public health sector in Sindh. *J Pak Med Assoc* 2003;53(8):324-7.
15. Schaaf, HS, Marais BJ, Hesselning AC, Brittle W, Donald PR. Surveillance of antituberculosis drug resistance among children from the Western Cape Province of South Africa: an upward trend. *Am J Public Health* 2009;99(8):1486-90.
16. Mulder C, Klinkenberg E, Manissero D, Effectiveness of tuberculosis contact tracing among migrants and the foreign-born population. *Euro Surveill* 2009;14(11):56-62.
17. Munch Z, Van Lill SW, Booysen CN, Zietsman HL, Enarson DA, Beyers N. Tuberculosis transmission patterns in a high-incidence area: a spatial analysis. *Int J Tuberc Lung Dis* 2003;7(3):271-7.
18. Leitch A. Audit of tuberculosis contact tracing procedures in South Gwent. *Respir Med* 1992;86(2):173.
19. Fox GJ, Barry SE, Britton WJ, Marks GB. Contact investigation for tuberculosis: a systematic review and meta-analysis. *Eur Respir J* 2013;41(1):140-56.

20. Starke JR. New concepts in childhood tuberculosis. *Curr Opin Pediatr* 2007;19(3):306-13.
21. Herrmann, JL, Belloy M, Porcher R, Simonney N, Aboutaam R, Lebourgeois M, et al. Temporal dynamics of interferon gamma responses in children evaluated for tuberculosis. *PLoS One* 2009;4(1):e4130.
22. Kumar S, Innes JA, Skinner C. Yield from tuberculosis contact tracing in Birmingham. *Thorax* 1992;47:875.
23. Achkar JM, Ziegenbalg A. Antibody responses to mycobacterial antigens in children with tuberculosis: challenges and potential diagnostic value. *Clin Vaccine Immunol* 2012;19(12):1898-906.
24. Steingart KR, Flores LL, Dendukuri N, Schiller I, Laal S, Ramsay A,, et al. Commercial serological tests for the diagnosis of active pulmonary and extrapulmonary tuberculosis: an updated systematic review and meta-analysis. *PLoS Med* 2011;8(8):e1001062.
25. Pareek M, Abubakar I, White PJ, Garnett GP, Lalvani A. Tuberculosis screening of migrants to low-burden nations: insights from evaluation of UK practice. *Eur Respir J* 2011;37(5):1175-82.
26. Janssen S, Huson MA, B  lard S, Stolp S, Kapata N, Bates M et al. TB and HIV in the Central African region: current knowledge and knowledge gaps. *Infection* 2014;42(2):281-94.
27. Khan MTR, Ahmed Z, Zafar M, Shafi K. Active case finding of sputum positive pulmonary tuberculosis in household contacts of tuberculosis patients in Karachi, Pakistan. *J Assoc Chest Physici* 2014;2(1):p25.
28. Sheikh MA, Naqvi SAH, Laghari TM, Chaudhry FF, Siddiqui B, Bokhari F, et al. Knowledge of Tuberculosis among Parents/Guardians of Children with Tuberculosis Attending the Outpatient Department of a Tertiary Care Hospital in Karachi. *World App Sci J* 2012;19(11):1653-8.
29. Odone A, Ricc   M, Morandi M, Borri  ni BM, Pasquarella C, Signorelli C, et al. Epidemiology of tuberculosis in a low-incidence Italian region with high immigration rates: differences between not Italy-born and Italy-born TB cases. *BMC Public Health* 2011;11(1):1.
30. Society JTCotBT. Control and prevention of tuberculosis in the United Kingdom: code of practice 2000. *Thorax* 2000;55(11):887-901.
31. Pothukuchi M, Nagaraja SB, Kelamane S, Satyanarayana S. Shashidhar, Babu S, et al. Tuberculosis contact screening and isoniazid preventive therapy in a South Indian district: operational issues for programmatic consideration. *PLoS One* 2011;6(7):e22500.
32. Kuaban C, Koulla-Shiro S, Lekama AT, Hagbe P. [Tuberculosis screening of patient contacts in 1993 and 1994 in Yaounde, Cameroon]. *Med Trop (Mars)* 1995;56(2):156-8.
33. Gilpin T, Hammond M. Active case-finding--for the whole community or for tuberculosis contacts only? *S Afr Med J* 1987;72(4):260-2.
34. Dhingra V, Rajpal S, Aggarwal N, Taneja DK. Tuberculosis trend among household contacts of TB patients. *Ind J Comm Med* 2004;29:44-8.
35. Tuberculosis. CDNA National guidelines for the public health management of Tuberculosis. The Department of Health, Australia 2015:1-19. (Accessed on 10th March 2017) Available from URL:<http://www.healthinfonet.ecu.edu.au/key-resources/promotion-resources?lid=28874>
36. Glaziou P, Sismanidis C, Floyd K, Ravigli  ne M. Global Epidemiology of Tuberculosis. *Cold Spring Harb Perspect Med* 2015;:1-19. (Accessed on 10th March 2017) Available from URL:<http://perspectivesinmedicine.cshlp.org/content/5/2/a017798.abstract>