
ORIGINAL ARTICLE

Pulmonary Tuberculosis in Household Contacts of Pulmonary Tuberculosis Patients Registered in Dots Implemented Tertiary Care Setting

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ABSTRACT

Introduction: Household contacts of pulmonary tuberculosis cases are the most risky group for tuberculosis infection /disease and are the easiest group to detect tuberculosis cases.

Objectives: This study was undertaken to describe the frequency distribution of active pulmonary tuberculosis in household contact of patients with active pulmonary tuberculosis

Setting and study design: This descriptive observational study was carried out in chest clinic of Sir Ganga Ram Hospital Lahore.

Patients and Method: Contacts aged >15 years of patients registered for treatment of tuberculosis at Model Chest Clinic, Sir Gangaram Hospital, Lahore were included in the study. The patients were asked to provide three sputum specimens two spot and one morning. Demographic features like age, sex and history of the disease were collected on a standardized questionnaire. Sputum smear microscopy for AFB was carried out at Model Chest Clinic by Zeihl-neelsen method.

Results: A total of 176 household contacts were investigated for active pulmonary tuberculosis. Of them 7(3.97%) out of 176 were pulmonary tuberculosis cases confirmed by microscopic examination of sputum smear by Z-N staining method. PTB was seen more in female 4(4.65%) out of 90 as compared to male 3(3.33%) out of 86. It is seen that contacts of index cases with advanced lesions on chest radiograph and positive sputum smear had active pulmonary tuberculosis, 4(5.00%) and 5(6.94%) respectively. Active PTB was found in 7(4.43%) out 158 contacts living in overcrowded houses. Out of 116 house hold contacts with no BCG scar, 5(4.41%) were cases of PTB.

Conclusion: Risk of active pulmonary tuberculosis (PTB) among household contacts is significant. Far advance lesion on chest x-ray, positive sputum smear of index case, lack of BCG scar in contact and overcrowding were associated with active pulmonary tuberculosis in household contacts.

Key words: Tuberculosis (TB), Pulmonary Tuberculosis (PTB), Acid fast bacilli (AFB), Ziehl-Neelsen staining (ZN), directly observed therapy short course (DOTS).

INTRODUCTION

Tuberculosis (TB) remains a major global health problem and is the most frequent cause of death from a single infectious agent. Pakistan is occupying 6th position in the list of the 22 high burden countries¹.

The first priority of tuberculosis control programme is to identify and treat all persons with active tuberculosis. The second priority is investigation of contacts to find persons who were exposed to tuberculosis patients and their evaluation for the extent of disease and active treatment of tuberculosis if required. The guidelines for contact investigation of TB patients have been published, it provides expanded plan for those who

were exposed to TB patients and in whom transmission of disease is suspected².

Contact investigation for cases of active pulmonary tuberculosis is standard practice in developed countries. Through this process, household and other close contacts of infectious case subjects are identified and tested for TB infection and disease. Several recent studies conducted in high burden areas have shown that active case finding among household contacts yields substantially more TB cases than passive case detection³.

Various studies of contact investigation have reported prevalence of active TB in 1.3 to 1.5 % of adult household contact⁴. Combined active and

Pulmonary Tuberculosis in Household Contacts of Pulmonary Tuberculosis Patients Registered in Dots

passive case finding in household contacts may detect substantially more cases of TB⁵.

Using sputum smear microscopy among symptomatic contacts of all ages, only 0.8% of cases were found among contacts of sputum smear-positive index cases in a study in eastern Nepal⁶. On the other hand, a study in Malawi identified contact tracing as a highly efficient activity for finding other than infectious cases, with a frequency of 7% of cases among contacts of newly identified sources of infection⁷.

The study was designed to screen household contacts of diagnosed cases of pulmonary tuberculosis and to identify symptomatic contacts to make early treatment possible through already running DOTS programme in the country.

MATERIALS AND METHODS

Study Design

A descriptive observational study was conducted in outpatient department of Model Chest Clinic, Sir Gangaram Hospital Lahore from Jan to Jun 2012. All of the identified adult household contacts (defined in this study aged >15 years) of pulmonary tuberculosis patients registered in chest clinic for treatment of tuberculosis. Contacts were asked to provide three sputum specimens two spot and one morning. Demographic features like age, sex and history of the disease were collected on a standardized questionnaire. Sputum smear microscopy for AFB was carried out at Model Chest Clinic by Zeihl-neelsen method. Convenience sampling method was used.

Infrequent visitors and contacts less than 15 years of age were excluded from the study.

RESULTS

All fifty seven diagnosed index cases of pulmonary tuberculosis were included in the study. Index cases of pulmonary tuberculosis belonged to age fifteen and above.

Among the fifty seven patients of pulmonary tuberculosis, 31 (54.83%) were male and 26 (45.61%) were female. 24(42.10%) patients had age range 15-34 year, 17(29.82%) patients had age range 35-44 and 16(28.07%) patients were above 55 years of age.

A total number of 199 household contacts were included in the study. 23(11.55 %) contacts aged fifteen and above could not be traced for investigation.

In this study there were 176 contacts, out of which 72(40.90%) were contacts of index cases

with positive sputum smear while 104(59.09%) patients were contacts of index cases with negative sputum smear.

Table-1 shows the prevalence of active pulmonary tuberculosis in household contacts of 57 index cases, out of 176 household contacts, 7 (3.87%) had active PTB.

Regarding ages in diagnosed TB contacts, out of 70 contacts in age range 15-34, 4(5.71%) had active pulmonary tuberculosis while 2 (3.70%) out of 54 and 1 (1.92%) out of 52 contacts had pulmonary TB were in age range 35-54 and 55 and above respectively.

Out of 90 male contacts 3(3.33%) had active pulmonary tuberculosis while out of 86 females 4(4.65%) had active PTB.

Out of 72 contacts of index case with positive sputum smear, 5(6.94%) had active pulmonary tuberculosis while out of 104 contacts of index cases with negative sputum smear 2(1.92%) had active PTB(Table-2)

Table 1: Frequency Distribution of Pulmonary Tuberculosis in Household Contacts n-176

Contacts	Number	Percentage
With Tuberculosis	7	(3.97%)
Without Tuberculosis	169	(96.02%)
Total	176	(100%)

Table 2: Frequency Distribution of Pulmonary Tuberculosis in Contacts by Smear Status of Index Case n-176

Smear Status of Index case	No of contacts	Tuberculosis in contacts
Positive	72	5(6.94%)
Negative	104	2(1.92%)
Total	176	7(3.97%)

39(22.15%) out of 176 household members had contact with pulmonary tuberculosis index cases having minimal radiological lesions, 57(32.38%) with moderately advanced radiological lesions while 80(45.45%) had contact with index cases having far advanced radiological lesions (Table -3).

Out of 60 contacts with history of vaccination suggested by BCG scar 2(3.33%) had active pulmonary tuberculosis while out of 116 contacts

having negative history of vaccination 5(4.41%) had active PTB (Table-4)

Table-5 shows that no contact living alone suffered from active pulmonary tuberculosis while out of 158 contacts sharing room 7(4.43%) had active tuberculosis.

Table 3: Frequency Distribution of Pulmonary Tuberculosis in Contacts by X-ray Findings of Index Case n-176

X-Ray Finding of index case	No of contacts of Index case	Tuberculosis in contacts
Minimal	39	1(2.56%)
Moderately advance	57	2(3.50%)
Far advanced	80	4(5.00%)
Total	176	7(3.97%)

Table 4: Frequency Distribution of Pulmonary Tuberculosis in Contacts by History of Vaccination n-176

History of vaccination	Number of contacts	Tuberculosis in contacts
Vaccinated	60	2(3.33%)
Not vaccinated	116	5(4.41%)
Total	176	7(3.97%)

Table 5: Frequency Distribution of Pulmonary Tuberculosis in Contacts by Sharing Room n-176

Sharing Room	Number of contacts	Tuberculosis in contacts
Single	18	0(0%)
>2 persons per room	158	7(4.43%)
Total	176	7(3.97%)

DISCUSSION

Tuberculosis is a neglected health crisis that is out of control in many parts of the world. In developing countries, the control of tuberculosis continues to be one of the major public health concerns. The idea of preventing the transmission of tuberculosis by better screening of contacts and consequent treatment of active tuberculosis cases is regarded as a part of tuberculosis control in developing countries. Effective TB contact investigation yields immediate results by identifying other sources of TB transmission and preventing future transmission through appropriate treatment of these contacts⁸.

A high prevalence of tuberculosis was found among household contacts. This may be explained, since Mycobacterium tuberculosis is virtually always transmitted by patient of tuberculosis to persons with whom he/she may be in contact. Persons living in the household of a tuberculosis patient are at high risk of developing tuberculosis themselves⁹.

It is well known that the risk of progression from primary infection to disease is much higher in young children than adults. Because this study enrolled only household contacts aged >15 years, any comparison with respect to detection of contacts with active TB in other countries, which involves children, is difficult.

There are few published studies on contact investigations in countries with high prevalence. The rate of active TB among contacts was found to be 14.6% in Cameroon, where half of the patients were aged <14 years.¹⁰ It was thought that lower detection rates of active TB during initial screening compared to these studies can be related to enrolment of only adults aged > 15 years.

When the rate of detection of contacts with active TB in this study at initial screening (3.97%) is considered, it is still higher than the rates in low-prevalence industrialized countries such as the UK (0.9%) and Australia(0.5%).^{11,12} However, it should be kept in mind that the selection of the index case(smear-positive or smear-negative), type of contact (household contacts, close contacts and all type of contacts) and age of the contacts are different in these studies.

In the US studies, active TB rates were found to be between 2% and 3% in close contacts of smear positive cases¹³⁻¹⁵ while studies in Spain showed rates of active TB among close contacts of 3.4% and 6%.^{16,17}

The observation in this study that more female contacts are infected is possibly to be expected in view of the closer relationship between the female contacts with index cases. Our findings differ from those in the majority of other contacts studies, in which higher rate of active tuberculosis among males (7.3 % vs. 4%) supports the notion that there is higher risk of developing tuberculosis during adulthood in males compared to female¹⁸.

In this study we found that the prevalence of disease was higher among the contacts of smear positive cases than in contacts of smear negative index cases. This finding is in agreement with previous studies conducted in Gambia (4% vs. 1%) and Iran (24.8% vs. 10.8%)^{19, 20}. On the basis of

this finding, it may be concluded that though the sputum positive patients pose a great problem to their contacts, the risk caused by smear negative index cases cannot be overlooked and the investigation of contacts of these patients is also essential with those of smear positive cases.

It is generally accepted that the number of infected contacts depends on the severity of disease in the index cases. The highest cases detected when index cases have a far advanced lesion on chest radiograph and produce a large volume of positive sputum. In a study conducted in Turkey, the incidence of tuberculosis in household contacts was found to be related with far advanced lesion and cavity on chest radiography in tuberculosis patient (7.4% vs.2.6%)²¹. The results of this study confirmed existing knowledge, that tuberculosis transmission was associated with far advanced lesion on chest x-ray.

The effect of poor socioeconomic condition on acquiring tuberculosis is a well-known entity. Overcrowded housing conditions have the potential to increase exposure of susceptible people to those with infectious respiratory disease, and may increase the probability of transmission of tuberculosis. The association between housing density and tuberculosis incidence has long been recognized. The study of Clark et al (2002) suggested that tuberculosis was higher in communities with higher average housing density²². In a comprehensive study conducted in Pakistan, Rathi et al showed that poor housing condition is a risk factor for the spread of *Mycobacterium tuberculosis*²³. The findings of our study are similar with these studied as it was seen that all 7(100%) contacts with pulmonary TB were living in overcrowded houses.

In one study the incidence of new cases of pulmonary tuberculosis in contacts that had previous BCG vaccination was significantly lower than that in non-vaccinated adult household contacts (1.15% vs. 3.06 %) suggesting a protective effect of BCG. These findings are consistent with this study (3.33% vs. 4.41%)²⁴.

The investigation of every contact is not always possible in either industrialized or developing countries. In several studies, 14% of contacts in England, 13% in USA and 10% in Hong Kong could not be investigated²⁵⁻²⁷, our study shows that 11% of contacts could not be investigated.

The study has some limitations. In this study all contacts aged <15 years were not investigated. Another limitation is that it is not always possible to

distinguish the index case from the source case. For this reason, active cases detected through contact investigation could perhaps be the source case. As all contacts aged < 15 years did not undergo contact investigation, the actual rate of active TB cases may be higher than observed in this study.

Although DOTS strategy is implemented in our setup, some of the components of TB control strategy like contact tracing is not being implemented properly due to scarce funding. Present study suggests benefits of household contact investigation. Furthermore, the results of this study suggest that NTP should undertake further research on the magnitude of household TB transmission and most effective ways to minimize this risk. Prospective operational studies will be needed to assess the magnitude of household transmission.

CONCLUSIONS

Household contacts of pulmonary tuberculosis cases are the most risky group for tuberculosis infection and are the easiest group to detect tuberculosis cases. Far advanced lesion on chest x-ray, positive sputum smear of index case, lack of BCG scar in contact and overcrowding were associated with active pulmonary tuberculosis in household contacts. 3.97% of household contacts were suffering from active pulmonary tuberculosis in this study. This warrants routine contact investigation.

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