

PREVALENCE OF PULMONARY TUBERCULOSIS IN CLOSE CONTACTS OF DIAGNOSED CASES OF PULMONARY TUBERCULOSIS

* Muhammad Aurangzeb, **Muhammad Masroor
Iftikhar Ahmed, *Rana Qamar
*****Abdul Sattar,***** Khlid Imran
*****Prof: Masood Hmeed Khan

ABSTRACT

Objective: To find out the frequency of pulmonary tuberculosis in close contacts of diagnosed cases of pulmonary tuberculosis whether smear -ve or smear +ve pulmonary tuberculosis

Setting: The study was conducted in Civil Hospital Karachi, Lyari General Hospital Karachi and OJHA Institute of Chest Diseases during a period of 3 months from July 2001 to September 2001.

Methods: Close contacts personal data and demographic were noted. A detailed relevant history was taken. On completion of history, general physical and systemic examination was done. Finally all relevant investigation including blood CP/ESR, Mantoux test (M.T), x-ray chest, PA view/Lordotic view if needed and sputum for AFB smear examination were performed and recorded on standard proforma.

Contacts were divided into two groups:

- (i) Contacts of smear +ve patients
- (ii) Contacts of smear -ve patients

The data were statistically analyzed on SPSS version 10.0 for Windows and Fishers Exact Test was applied.

**Medical Officer*

***Associate Professor*

****Assistant Professor*

*****Assistant Professor*

******Medical Officer*

******Senior Medical Officer*

Medical Unit III, Dow Medical Collage & Civil Hospital Karachi

Results: Two hundred eighty seven close contacts of 50 diagnosed cases of tuberculosis were included in this study. The age ranges between 4 to 66 years. There were 140 males and 147 females. Over all 26 contacts (15.3%) were found to be suffering from Pulmonary tuberculosis. These included 24 (13.3%) contacts of smear +ve patients and 2 (2%) contacts of smear -ve patients ($p = 0.000396$).

Conclusion: We concluded from this study that there is significant transmission of tuberculosis from a patient of pulmonary tuberculosis to the contacts.

Moreover it further showed that smear +ve cases are highly infectious when compared with smear -ve cases

Key words: Tuberculosis, Contacts, Smear positive, Smear negative.

Introduction

Tuberculosis is an ancient human disease that has long been a major Public health challenge in the world and remains a major health problem in most developing countries. In recent days tuberculosis has become the most important communicable disease in the world especially in most developing countries including Pakistan. About 1/3 of the world population is infected by *Mycobacterium tuberculosis*. In 1995 there were at least 9 million new cases of tuberculosis with 3 million deaths.

Tuberculosis continues to be a public health problem in Pakistan. There is little epidemiological data available in Pakistan about tuberculosis.

In Pakistan from 110,000 to 130,000 new TB cases are found each year². During 1990-91 there were 105000 admissions with medical problems in thirty major hospitals in Pakistan out of which 65000 had pulmonary tuberculosis³.

The tuberculosis infection is transmitted through air when infectious people cough, spit, talk or sneeze and singing and other respiratory maneuvers will generate droplet nuclei due to evaporation of small respiratory droplets. The entry of bacilli in the body is not necessarily followed by disease. The development of disease is dependent upon several factors like the natural resistance of the host, the over crowding, poverty and any inter current illness. In general prolonged contact with infectious case is necessary before infection is acquired. On the other hand⁴ infection may be acquired by single exposure, for example in laboratories and postmortem rooms

The most powerful weapon for controlling and preventing tuberculosis are case finding and a treatment with a view to prevent the spread of *mycobacterium tuberculosis* from a smear +ve case. Smear +ve patient⁵ is 4-20 times more infectious. Untreated, a smear +ve patient may infect 10-15 persons per year.

All contact of infectious tuberculosis patients whether symptomatic or asymptomatic should be screened by tuberculin skin testing and chest films and in case of cough AFB smear and culture examination of the sputum. Priority should be given to house holds and close family contacts of smear +ve cases of pulmonary tuberculosis where 10-14% of the contacts have been found to have disease⁶.

The present study is under taken to find out the prevalence of pulmonary tuberculosis in close contacts of diagnosed cases of pulmonary tuberculosis to provide early treatment and prevention of spread of the disease

Patient's And Methods

In this study we screened 287 family members and (close contacts) of 50 diagnosed cases of pulmonary tuberculosis, attending the medical and chest OPD's of Civil Hospital Karachi, Chest Clinic at Lyari General Hospital Karachi and OJHA Institute of chest diseases Karachi for the evidence of Pulmonary tuberculosis during a period of 3 month from July 2001 to September 2001.

Out of which 180 were contacts of 30 smear positive patients and 107 were close contacts of 20 smear -ve patients.

A detailed relevant history regarding the symptoms of tuberculosis was taken and relevant general physical and systemic examination was done.

After history and examination, following investigation were done to evaluate the evidence of pulmonary tuberculosis.

Blood CP/ESR
Mantoux test (M.T)

5-T.U of PPD-S with Tween 80 in a dilution 1:1000 was injected intradermally over the volar surface of the forearm and induration at the skin site measured after 48-72 hours.
M.T \geq 5mm was taken as positive in contacts

X-ray chest PA view.
X-ray chest lordotic view if needed.
Sputum microscopy for AFB.

In all the Patients who were producing sputum, 3 early morning specimen were taken and smear stained by Ziel-Neelsen method and examined by light microscopy. There must be minimum 3 AFB on ZN staining on the slide before considerable positive.

The data were recorded on standardized proforma

Statistical Analysis

The data were statistically analyzed on SPSS version 10.0 and Fisher's Exact Test was applied to calculate the P value.

Inclusion Criteria

Family members living in the same house.
Those contacts working in the same premises.

Exclusion Criteria

Infrequent visitors.

Results

287 close contacts of 50 diagnosed cases of pulmonary tuberculosis were included in this study. One hundred eighty were contacts of 30 smear positive pulmonary tuberculosis patients and 107 were contacts of 20 smear negative pulmonary tuberculosis.

Out of 180 contacts of smear positive pulmonary tuberculosis 84 were male and 96 were female, 42 (23.33%) were between the age 1-10 years, 76 (42.22%) were between the age of 11-20 years, 30 (11.11%) were between the age 21-30 years, 16 (8.88%) were between the age of 31-40 years, 15 (8.33%) were between the age of 41-50 years, 9 (5%) were between the age of 51-60 years, 2 (1.11%) above the age of 60. (Fig-1)

Out of 107 contacts of smear negative patient 56 were male and 51 were female. Ten (9.34%) were between the age of 1-10 years, 54 (50.46%) between the age of 11-20 years, 14 (13.08%) between the age of 21-30 years, 8 (7.47%) between the age of 31-40 years, 9 (8.41%) between the age of 41-50 years, 10 (9.34%) between the age of 51-60 years and 2 (1.86%) > 60 years. (Fig-2)

Out of 180 contacts of smear positive patient 53 (29.4%) had cough, 25 (13.9%) had fever, 28(15.6%) had chest pain, 15(8.33%) had H/O weight loss, 13(7.22%) had dyspnea. (Fig-3)

Out of 107 contacts of smear negative patient 12(11.2%) cough, 3 (2.8%) had fever, 5 (4.6%) had chest pain, 4 (3.73%) had dyspnea. (Fig-4)

* MANTOUX TEST IN CONTACTS OF SMEAR POSITIVE PATIENTS

70 contacts out of 180 smear positive had M.T. induration less than 5 mm, (46.11%), 79 patient (43.88%) had M.T. induration between 5-9 mm, and 31 (17.22%) had M.T. induration of more than 10mm. (Table 1)

* MANTOUX TEST IN CONTACTS OF SMEAR NEGATIVE PATIENTS

In 90 (84.1%) out of 107 contacts of smear negative contacts had M.T. induration less than 5 mm, 13 (12.1%) had M.T. induration between 5-9mm and 4 (3.8%) had M.T. induration \geq 10. (Table 2)

* Radiography

The chest radiographs were taken of all 287 contacts of both smear positive and smear negative

Patients. Thirty two contacts out of 180 contacts of smear positive patients had abnormal x-ray finding and 24 out of 32 had abnormal chest x-ray finding suggestive of pulmonary tuberculosis and 8 patients had finding suggestive of COPD. Out of 24 abnormal x-ray findings which suggestive of tuberculosis 14 had unilateral lung involvement, out of 14, 8 had minimal disease (less than 1/3 of the lung involved), 7 had moderate disease and 1 had extensive disease, 10 had bilateral lung involvement, 8 had moderate lung involvement and 2 had extensive bilateral lung involvement. One patient out of these 10 had pleural effusion. The radiological findings usually seen were patchy consolidation 72%, fibrosis 56%, and cavitation 8%.

Five contacts out of 107 contacts of smear negative patient had abnormal x-ray finding. Two out of 5 x-rays had finding suggestive of tuberculosis in the form of patchy consolidation, one out of these two had left sided pleural effusion and 3 patients had abnormal x-ray chest due to COPD.

Sputum Smear Examination

Sputum examination was done in 40 contacts who were producing sputum and out of which one was positive for AFB.

Blood CP/ESR

In all the 287 contacts of both smear positive and smear negative patients blood CP/ESR were done to see the Hematological finding supportive of pulmonary tuberculosis.

8 out of 180 contacts of 30 smear positive patients had Hb concentration < 10 gm (4.44%) 90 had Hb % between 10-12 gm (50%) and 82 had Hb more than 12 gm/dl (45.55%)

168 contacts out of 180 had TLC count between the range of 4000-11000 (93.33%) while 12 patients had TLC > 11000 (6.66%). One hundred thirty contacts out of 180 had ESR <20 (72.22%), 26 had ESR between the range of 20-50 (14.447%) and 24 had ESR above >50 (13.33%)

One patient out of 107 contact of smear negative patients had Hb < 10gm (93%) 36 contacts (33.64%) had Hb between 10-12 gm and 70 contacts (65.42% had Hb > 12 gm).

One hundred one out of 107 contacts of smear negative patients had total leucocyte count between 4000 to 11000 (94.39%) and 6 had TLC > 11000 (5.60%).

One hundred one contacts out of 107 had ESR < 20 (94.39%), 5 (4.67%) had ESR between 20-50 and 1 had ESR > 50 (.93%).

On the basis of symptom, x-ray chest finding, Mantoux test and supported by ESR, 24 patients out of 180 contacts 7 smear positive patient had pulmonary tuberculosis (13.35) and 2 patients out of 107 contact had pulmonary T.B. 2%. (Table 3)

Discussion

Tuberculosis is an ancient human disease that has long been a major public health challenge in the world and remains a major health problem in most of the developing countries. Like common cold, the tuberculosis infection is transmitted through the air when infectious peoples coughing, spiting, talking, sneezing, singing and other respiratory maneuvers will generate droplet nuclei due to evaporation of small respiratory droplets.

Smear positive patients are more infectious and a single smear positive patient is 4-20 times more infectious as compared to smear negative, an untreated smear positive patient may infect 10-15 persons per year.

The study of contacts of patient with tuberculosis is an important preventive measure which helps to identify the risk factors for contagion to detect new cases of the disease early and to break the epidemiological chain of transmission.

In this study we traced 287 close contacts of 50 diagnosed cases of pulmonary TB who were living in the same house and/or those working in the same premises.

Contacts were divided in to two groups:

- (i) Contact of smear positive patients.
- (ii) Contacts of smear negative patients.

These contacts whether symptomatic or asymptomatic were evaluated by history, examination, and laboratory investigation.

The cough was present in 53 out of 180 contacts of smear positive cases. Twelve out of 53 had cough mainly in morning and most probably due to COPD. 8 have cough due to acute respiratory tract infection, 13 had problem of deviated nasal septum and sinusitis which led to postnasal dribbling and cough. Twenty contacts which had cough correlate with x-ray chest, M.T. and supportive by ESR, was turned out to be tuberculous in origin. Like smear positive contacts, 12 out of 107 contacts of smear negative patient had cough. Five out of 7 smear negative patient had cough. Five out of 12 had history of the smoking with cough mainly in morning time and probably dribbling and 2 patient who had cough correlate with x-ray chest, M.T. & supported by ESR turned out to be tuberculous in origin.

Twenty five contacts of smear positive patients presented with fever. Two out of 25 had fever due to UTI, 3 had fever due to respiratory had infection and 20 patients who had fever when correlate with other symptoms, x-ray chest, M.T and ESR turned to be tuberculous.

Twenty eight contacts of smear positive pulmonary tuberculosis had chest pain. Four patients had chest pain due to exacerbation of COPD, 6 had chest pain due to ischemic heart disease (IHD), proven by ECG, one patient had chest pain due gastroesophageal reflux disease, 17 contacts who had chest pain correlate with other symptoms, x-ray chest, M.T. and supported by CP/ESR turned out tuberculous. Five contacts of smear negative patient had chest pain. 2 patients had chest pain due to IHD, one had chest pain due to COPD, 2 when correlate with other symptoms, x-ray chest, M.T and CP/ESR turned to be tuberculous.

Thirteen contacts of smear positive patient had dyspnea, 4 had dyspnea due to COPD, 3 had dyspnea due to left ventilator dysfunction secondary to IHD, 6 had dyspnea correlate with x-ray chest, M.T. & CP/ESR tuberculous in origin. Four contacts of smear negative patient had dyspnea. One had dyspnea due to IHD and one when correlate with other symptom, x-ray chest, M.T. and CP/ESR turned out tuberculous in origin.

Fifteen contacts of smear positive had H/O weight loss. All are attributed to pulmonary tuberculosis.

Mantoux test was ≥ 5 mm in 110(61.11%) of contacts of smear positive patient out of these 17 were children under age > 7, vaccinated with BCG, so in these cases M.T. was not taken as positive. So M.T. was positive in 93 (51.66%) cases.

This is consistent with the studies done by Fernandez Revuel TA et al⁸, Lutongl et al⁹ and Ponticello A et al¹⁰ which shows 53.4% and 42% M.T. positive in close contacts smear positive tuberculous patient respectively.

On the basis of history, examination and laboratory investigation and radiography, 24 (13.3%) contacts of smear positive patients had disease. Out of these 11 were male and 13 were female, 4 cases were between the age of 1-10 years, 12 were between the age of 11-20 years, 3 between 21-30 year, 3 between 31-40 years, one (1) between 41-50 year and one above 50 years.

This disease was more frequent in 11-20 years age groups, this may be because of immunity provided by BCG is waning. They remains most of the time in home, puberty and hormonal changes alter the internal milieu of the body, and dependent on other family members.

Less frequency of disease in age group 1-10 years may be due to immunity provided by BCG vaccination.

In other groups the less frequency of the disease may be due to fact that they remain most of time out of home for the purpose of jobs, services etc. Hence they had comparatively infrequent contact with the index case. Better eating and recreation facilities may also be responsible for the decreased incidence of disease.

Socioeconomic: The 50 families which were included in this study belonging to poor, lower middle class and middle class. 75% had a monthly income of less than 3000, 20% had income between 3000-6000 and 5% had income above 6000. The disease is more prevalent in people who had their income >3000, the reason for the more prevalent in low income people are poverty, overcrowding, poor sanitary condition.

No ethnic group was more susceptible for the development of infection. No sex difference for the more prevalence of disease was seen. The disease was more prevalent (80%) in those contacts who were with close proximity (living in same room, volume of air shared by) as compared to those who are not in close proximity.

The result of our study are consistent with studies by Vidal N et al¹¹, Capwell B, Leitch A G et al¹², Payne CR et al¹³ which showed 8%, 14%, 12% pulmonary tuberculosis disease in close contacts of the smear positive patients respectively. The above studies showed that the disease is more prevalent in those who are very close and prolonged contact with the index case as our study showed.

On the basis of history, examination, laboratory investigations (2%) contacts of smear negative patient had pulmonary tuberculosis. Both cases which had pulmonary tuberculosis were female, one was 20 years old and other was 14 years old. We do not know whether the female who had developed disease, previously come in contact with any smear positive patient, or their index case had sputum AFB culture positive, because AFB culture sputum positive patient had less transmission as compared to smear positive patient.

This is consistent with study of Vidal R et al¹⁴ which show 3% disease in close contacts of smear negative patients.

There is no local data available to compare our study.

There is statistically significant transmission of tuberculosis from smear positive patients as compared to smear negative (P=0.000398).

CONCLUSION

In conclusion it is clear that there is significant transmission of tuberculosis from a patient of tuberculosis to contacts. The study of contacts appears a high yield in the diagnosis of new tuberculosis cases. Moreover, it allows the detection of newly infected subjects in whom application of chemoprophylaxis prevents the development of disease, the diagnosis, and thus the epidemiologic chain of transmission is broken.

TABLE 1
Mantoux Test in Smear positive patients

M.T. mm	Frequency of contacts	Percentage
< 5 mm	70	38.88%
5-9 mm	79	43.88%
> 10 mm	31	17.22%

TABLE 2
Mantoux Test in Smear negative patients

M.T. mm	Frequency of contacts	Percentage
< 5 mm	90	84.6%
5-9 mm	13	12.1%
>10 mm	4	3.8%

TABLE 3
Frequency of disease in close contacts of
smear +ve and smear -ve patients
(N1 = 180, N2 = 107)

	Disease Positive	Disease Negative
Smear positive	24 (13.3)	158 (86.7%)
Smear negative	2 (2)	105 (98%)

P-Value is 0.000396 (by Fisher's Exact test)
P < 0.05 considered significant.

REFERENCES

1. Treatment of T.B. Guideline for national Program. Second Edition 1997, WHO.
2. A. De Muynck. Tuberculosis in Pakistan major Public Health Problem 2001, 1-4
3. Samen Siddiqui, Hafiz Awais Elahi, Muhammad Hussain, Dilshad Ahmed Khan. Evaluation of adrenal function in long standing pulmonary tuberculosis. JPMA Vol. 4; May 1997: 132.
4. Collins CH (1982). Laboratory acquired tuberculosis . Tubercle 63, 151
5. World Health Report 1999. www.who.com.tb
6. S.Satya Siri. Case finding. In: Textbook of pulmonary and extra pulmonary tuberculosis. 3rd edition 1998: 167.
7. Harrison. Principles and practice of internal medicine. 14th ed. 1998; 1004-1006
8. Fernandez Revuelta A, Arazo Graces P, Aguirre Errasti JM, Arribas Lioreute JL. The study of contacts of tuberculous patients. Servicio de Enfermedades Infecciosas. Hospital Miguel Servet, Zaragoza.
9. Lutong L, Bei Z. Association of prevalence of tuberculin reactions with closeness of contact among household contacts of new smear positive pulmonary tuberculosis patients. Int J Tuberc Lung Dis 2000 Mar; 4 (3): 275-7.
10. Ponticiello A, Perna F, Sturkenboorm MC, Marchetiello I, Bocchino M, Sanduzzi A. Demographic risk factors and lymphocyte populations in patients with tuberculosis and their healthy contacts. Int J Tuberc Lung Dis 2001 Dec; 5(12): 1148-55.
11. Vidal R, Miravitles M, Cayla JA, Torrella M, Martin N, de Garcia J. A contagiousness study in 3071 familial contacts of tuberculosis patients. Servicio de Neumologia, Hospital General Universtari Vall d'Hebron, Barcelona.
12. Capwell S, Leitch AG (1984). The value of contact procedure for tuberculosis in Edinburgh Br J Dis Chest 78, 317.
13. Payne CR (1978). Surveillance of tuberculosis contacts? Experience at Ealing Chest Clinic Tubercle 57, 179.