A STUDY OF FACTORS AFFECTING SPUTUM CONVERSION IN PATIENTS OF PULMONARY TUBERCULOSIS

Sheetal D Vora[1], Rina V Gandhi[1], Sanket A Vasava[2], Aruna R Ganava[2], Gunjan Amin[2]

Author's Affiliation:
[1]Assistant Professor; [2]Post Graduate Students, Department of Medicine, Smt NHL Municipal Medical College, Ahmedabad

Correspondence:
Dr Sheetal D Vora
Email- shee43@gmail.com

ABSTRACT

Background: In the era of direct observation treatment (DOT) for tuberculosis, clinicians need to focus on high risk groups. We present sputum conversion rate at 2 months and factors influencing it.

Objectives: To determine factors that prolong sputum smear conversion among smear positive pulmonary tuberculosis patients at the end of the Intensive Phase.

Method: 150 adult (> 18 years) patients of sputum smear positive pulmonary tuberculosis were included. 2 months following DOT, sputum was retested to determine sputum conversion rate.

Results: Of 150 sputum positive TB cases, 123 (82%) patients were sputum negative 2 months after DOT. In this study we found that among 43 patients of age > 50, after two months of treatment, 15 (35%) patients were sputum smear positive. Among 66 smoker patients, 19 (20%) patients were sputum smear positive. Among 24 patients of bilateral X-Ray involvement, 12 (50%) patients were sputum smear positive. Out of 40 patients of +3 bacillary load, 17 (42%) were sputum smear positive.

Conclusion: Factors affecting sputum conversion in this study were male patients, patients with age > 50 years, smokers, patients with past history of pulmonary tuberculosis, bilateral involvement in chest x ray and high bacillary load (+3).

Keywords: Tuberculosis, Direct Observation Treatment

INTRODUCTION

Tuberculosis remains one of the world's deadliest diseases. Sputum Acid Fast Bacilli (AFB) positive Pulmonary Tuberculosis is the infectious form of tuberculosis and is mainly responsible for transmitting the disease. An untreated patient is likely to infect another 10-15 cases each year. Transmission is through droplet nuclei, which are airborne from the index cases. [1] Susceptibility of developing tubercular infection depends upon bacillary load, close contact with the patient and duration of antitubercular treatment. [2]

On starting effective antitubercular treatment, bacillary load decreases rapidly, which correlates with reduced infectivity. In spite of various serological markers, sputum AFB remains the important measure for the treatment response. [3] Delay in sputum

AFB smear conversion at 2-3 months is one of the predictors of treatment failure and relapse. [4]

If potential factors associated with the persistent sputum positivity at the end of 2–month therapy are known, they may be helpful in stratifying patients according to risk of adverse outcome. This current study was performed to identify risk factors associated with persistent sputum positivity at the end of 2 months of direct observed treatment (DOT), which could be used under programmed conditions in low-income countries.

OBJECTIVES

Objectives of this study were to determine factors that prolong sputum smear conversion among smear positive pulmonary tuberculosis patients at

the end of the Intensive Phase and to know the impact of pre-treatment bacillary load on sputum smear conversion.

MATERIALS AND METHODS

This is prospective observational study done in tertiary care hospital attached with teaching institute. We enrolled 150 smear positive patients from july 2012 to January 2015.

All sputum smear positive pulmonary tuberculosis adult patients (age ≥ 18 years) of category 1 and category 2 under intensive phase therapy, registering under the Revised National Tuberculosis Control Programme at DOTS centre tuberculosis unit, were included in this study.

Patients with age less than 18 years, patients with seriously ill extra-pulmonary TB like meningitis, disseminated tuberculosis, tuberculous pericarditis, peritonitis, bilateral extensive pleurisy, spinal disease with neurological complications, intestinal and genito-urinary tuberculosis, miliary tuberculosis and patients on immuno-suppressive therapy were excluded from the study.

Method of collection of data: Permission for the study was obtained from the District Tuberculosis Officer. The patients were explained about the purpose of the study. Detailed history was taken and general and systemic physical examination was done. 150 consecutive patients who were sputum positive for acid fast bacilli (AFB) and meeting RNTCP guidelines for Category 1 and Category 2 were included in the study. Total duration of study was from July 2012 to January 2015. After obtaining informed consent from the patients, a pre-tested and semi-structured questionnaire was used to collect the relevant clinical history, addictions, sputum smear grading and co-morbid conditions such as HIV, diabetes mellitus, under-nutrition and alcoholic liver disease. Patients were subjected for general physical examination, systemic examination and anthropometric assessment.

The HIV status of the patients was elicited from the patient's Revised National Tuberculosis Control Programme treatment card. The patients were screened for diabetes by checking their random blood sugar by finger-prick method using the glucometer. The patients were screened for alcoholic liver disorders by looking for the signs of jaundice in various anatomic body sites & history of alcoholism. Body Mass Index was calculated for the patients to look for under-nutrition, if any.

All the clinical data was recorded in the proforma. Sputum smears were examined for acid fast bacilli on day 60. Three sputum specimens were examined (spot, early morning and spot) as per the RNTCP

guidelines. Cases which were sputum positive at 60 days were continued intensive treatment and then follow up sputum examination done.

Sputum Microscopy Procedure: A good wide-mouthed disposable sputum container made of clear thin plastic, unbreakable and leak proof material was selected. Each patient was given a sputum container with the laboratory serial number written on it. The patient was shown how to open and close the container and instructed not to rub off the number written on the side of the container. Patient was instructed to inhale deeply 2-3 times and cough out deeply from the chest and spit in the sputum container by bringing it closer to the open mouth. The patient was given another container with laboratory serial number written on it for an early morning specimen. It was explained to the patient to rinse his/her mouth with plain water before bringing up the sputum. A third spot sputum sample was collected when the patient brought the second sample to the laboratory.

Sputum smear was prepared and stained with Ziehl Neelsen staining technique[5] and smear grading was done as shown in table.

Table-1- Grading of the sputum smears

Examination	Result	Grading	Fields to be examined
>10 AFB per oil immersion Fields	Positive	3+	20
1-10 AFB per oil immersion fields	Positive	2+	50
10-99 AFB per 100 oil immersion fields	Positive	1+	100
1-9 AFB per 100 oil immersion fields	Scanty	Record exact number seen	100
No AFB per 100 oil immersion fields	Negative	0	100

The patients were followed up till the completion of their intensive phase of treatment. The bacteriological smear grading of the patients at the end of the Intensive Phase was assessed as mentioned earlier. The Smear Conversion Rate was calculated as per Revised National Tuberculosis Control Programme guidelines. After obtaining the data, the medico social factors responsible for delay in smear conversion were analysed by using statistical tests.

DEFINITIONS

Sputum smear conversion is the change in the bacteriological status of sputum of patients from initial AFB positive to AFB negative after treatment.

Sputum conversion rate was calculated as per the Revised National Tuberculosis Control Programme guidelines by taking the number of patients who

had their sputum converted to smear negative at the end of intensive phase including patients whose sputum was positive at the end of the 2nd month but negative at the end of 3rd month divided by the number of smear positive patients stated on treatment. The ratio is multiplied by 100 for obtaining a percentage.

Smear Conversion Rate is proportion of number of sputum smear positive patients converted to sputum smear negative at the end of intensive phase out of total number of sputum smear positive patients initiated on treatment.

Radiology findings: Chest X-rays were characterized according to extension (unilateral, bilateral) and cavitation.

Treatment: The patients were administered standard regimens of anti-tuberculosis drugs as prescribed under DOTS for the specific period of time. The sputum of each patient was re tested at the end of 60 days. The drugs were administered to patients by the health worker under his/her direct observation as prescribed under DOTS.[6]

Statistical analysis: Results were subjected for appropriate statistical analysis. Chi-square test was used for analysing categorical data. Multivariate analysis (multiple logistic regressions) was done to evaluate the predisposing factors for delay in sputum smear conversion. p value <0.05 is significant.

RESULT

Out of 150 patients 112 (75%) patients were male and 38 (25%) patients were females. In this study group, age group of 41-50 had the highest incidence of sputum positive pulmonary tuberculosis with 30.7%.

Risk factors: Out of 150 patients 43 (28.66%) patients were of age > 50 years. Habit of smoking was there in 66 (44%) patients. History of dibetes and HIV was found in 40 (26.66%) and 12 (8%) patients respectively. Past history of tuberculosis was found in 20 (13.33%) patients.

Radiological involvement: Out of 150 patients,126 patients had unilateral involvement and 24 patients had bilateral involvement.

Cavitation in X-ray Chest PA View: Single or multiple cavitations in X Ray were found in 45 patients and 105 patients had no cavities in chest X Ray.

Out of 150 patients of sputum positive pulmonary tuberculosis, 123 (82%) were sputum negative after 2 months' anti tubercular treatment as per RNTCP Guidelines. 27 were still sputum positive after 2 month of anti-tubercular treatment. In my study sputum conversion rate was 82%

Table 2- Age wise & sex wise distribution of smear positive patients

Age group (Years)	Male (n=112) (%)	Female (n=38) (%)	Total (n=150) (%)
18 to 30	20 (17.85)	8 (21.05)	28 (18.7)
31 to 40	25 (22.32)	8 (21.05)	33 (22)
41 to 50	38 (33.92)	8 (21.05)	46 (30.7)
51 to 60	23 (20.53)	13 (34.21)	36 (24)
61 to 70	4 (3.57)	1 (2.63)	5 (3.3)
>70	2 (1.78)	0	2 (1.3)

Table 3: Sputum smear grading in smear positive patients

Smear Grading	Patients (n=150) (%)
Scanty	14 (9.3)
+1	42 (28)
+2	54 (36)
+3	40 (26.7)

Table 4 - Factors affecting sputum smear conversion

	Patients (n=150)	Sputum smear positive after 2 months (%)
Age		
<50	107	12 (11.2)
>50	43	15 (35)
Gender		
Male	112	23 (20)
Female	38	4 (11)
Smoking		
Smoker	66	19 (20)
Non smoker	84	8 (10)
P value		0.01
Radiological involvement		
Unilateral	126	15 (11)
Bilateral	24	12 (50)
Cavitory changes		
Yes	45	9 (20)
No	105	18 (17.1)
Sputum grading		
Scanty	14	0
+1	42	3 (7)
+2	54	7 (17)
+3	40	17 (42)

Table 5- Associated co morbid conditions affecting smear conversion

Conditions	Patients (n=150)	Sputum +ve after 2 mnths (n=27)	Positivity rate	P Value
Diabetic	40	5	12.5	0.167
HIV Positive	12	2	16.0	0.775
Respiratory Disease	30	6	20.0	0.114
Previous Tuberculosis	20	3	23.0	0.001

Age more than 50 years had 65% sputum conversion rate and less than 50 years had 89% of sputum

conversion rate. High bacillary load (+3 sputum grading) had 42% late sputum conversion than in +2 and +1 sputum grading, which was 24%..

DISCUSSION

In this study we found that maximum number of patients, 46 (30.7%) were in age group of 41 to 50 years. This finding is comparable with SIMMI et al[7] study in which maximum number of patients, 118 (35%) ,were in age group of 41-50 years. This finding is also comparable with Parikh study[8] in which maximum number of patients, 25 (33%) were in same age group.

In this study there were 112 (75%) males and 38 (25%) female patients. This finding is comparable with Bawri et al.[9] study which shows 75 (75%) male and 25 (25%) female patients. This finding is also comparable with Mota et al.[10] study which shows 102 (75%) male and 34(25%) female patients.

In present study we found that 124 (82%) patients had unilateral radiological involvement and 26 (18%) patients had bilateral involvement. This finding is comparable with SIMMI et al study[7] which shows 264 (78%) and 74 (22%) patients with unilateral and bilateral radiological involvement respectively.

In present study 105 (70%) patients had no cavitory changes in X ray and 45 (30%) patients had cavities in X ray. This finding is comparable with Edward Telzak study[1] which shows 77 (77%) patients without cavitory changes in X ray and 23 (23%) patients had no cavitory changes in X ray.

In this study we found that maximum number of patients, 54 (36%), had +2 bacillary load .In Nwokeukwu[11]study maximum number of patients, 43%, had +1 bacillary load. In Mota et al[10] study maximum number of patients , 49 (53%), had +3 Bacillary load.

In this study sputum conversion rate was 82%. This finding is comparable with Simmi study[7], Parikh study[8], Bawri study[9], Rajiv Khandekar study[2] and Mota study[10] which shows sputum conversion rate of 76%, 84%,84%, 78.5% and 78% respectively.

Age more than 50 years had 65% sputum conversion rate and less than 50 years had 89% of sputum conversion rate. Younger patients were more educated and regular in taking drugs with lower incidences of treatment incompliance, less co morbid conditions, good food habits as compared to older patients.

Sputum conversion rate in female (89%) were more than males (80%). Males had habit of smoking, alcohol, tobacco and more exposure to occupational hazard as compared to females.

Smokers had sputum conversion rate 80% than in non-smokers 90%. In my study group smokers continued smoking with treatment and they had long history of smoking of average 18 years. There was insufficient data of smokers in my study of which type of smoking material they used and how many times per day.

In this study, sputum conversion, in patients with past history of pulmonary tuberculosis and treated with anti-tuberculous drugs as per RNTCP Guideline, was late. p value was 0.0001. This may be due to drug resistance, irregular in taking drugs, incompliance with treatment.

In radiological finding, bilateral involvement had late sputum conversion.50% of patient with bilateral involvement had late sputum conversion than 11% in unilateral involvement. There was much area involvement, more aggressive, more infectious, with more clinical symptoms and bacillary load in bilateral lung tuberculosis than unilateral involvement.

Table 6 - Associated co morbid conditions and habits

Condition	Present study (n=150)	Mota[10] study (n=136)	Khalid[12] study (n=119)	Aylin[13] study (n=160)
HIV	12	15	1	-
(P value)	(0.775)	(0.468)	(0771)	
DM	40	10	9	49
(P value)	(0.167)	(0.468)	(0.770)	(0.126)
Smokers	66	75	43	28
(P value)	(0.01)	(0.065)	(0.01)	(0.001)

These P values were significantly comparable with Mota study, Khalid study and Aylin study. Associated diseases like Diabetes, HIV and respiratory disease had no role in sputum conversion. Non-significant p value was found in my study. Diabetes patients were regular in treatment of diabetes as well as tuberculosis. They regularly attended physician for diabetes and maintained blood sugar level.

HIV positive patients were regular on anti-retroviral therapy, regularly attended ART centre and well educated about HIV and TB. They were regular in checking CD4 count and maintained CD4 count above 350. They had no other complication during 2 months of intensive therapy of TB.

CONCLUSION

From this study we conclude that Factors affecting sputum conversion in pulmonary tuberculosis were male patients, age more than 50 years patients, smokers, past history of pulmonary tuberculosis, bilateral involvement in chest x ray and high bacillary

load (+3) in sputum. Factors that were not affecting sputum conversion were associated co-morbid conditions like DM and HIV.

Therefore, the programme's recommendation of treating all smear positive pulmonary tuberculosis patients with anti tuberculosis regimen irrespective of associated co-morbid conditions is appropriate.

BIBLIOGRAPHY

1. Telzak EE, Fazal BA, Turett GS et al. Factors influencing time to sputum conversion among patients with smear-positive pulmonary tuberculosis. Clin Infect Dis 1998; 26(3):775-776.

2. Sumant Pajankar, Rajiv Khandekar, Musallam Amer Al Amri et al. Factors affecting sputum smear conversion at one and two months of tuberculosis treatment. Oman Medical Journal 2008;23(4): 263-268.

3. Epstein MD, Schluger NW, Davidow AL et al. Time to detection of Mycobacterium tuberculosis in sputum culture correlates with outcome in patients receiving treatment for pulmonary tuberculosis. Chest 1998; 113(2):379-386.

4. Singla R, Osman MM, Khan N et al. Factors predicting persisting sputum smear positivity among pulmonary tuberculosis patients 2 months after treatment. Int. J Tuber Dis 2003;7(1):58-64.

5. Ananthanarayan and Paniker. Ananthanarayan and paniker's textbook of microbiology, 9th edition. Hyderabad: universities press (India) private limited; 2013. p13-14.

6. World health organization, stop Tb department. Treatment of tuberculosis guidelines, 4th edition. Switzerland: WHO press;2010. p 30.

7. Simmi Tiwari, Amod Kumar, Kapoor SK. Relationship between sputum smear grading and smear conversion rate and treatment outcome in the patients of pulmonary tuberculosis undergoing DOTS. Indian J Tuberc 2012;59(3): 135-140.

8. Parikh R, Natraj G, Kanade S, Khatri V, Mehta P. Time to sputum conversion in smear positive pulmonary TB patients on category I DOTS and factors delaying it. J Assoc Physicians India 2012;60:22-6.

9. Bawri S, Ali S, Phukan C, Tayal B and Baruwa P. A study of sputum conversion in new smear positive pulmonary tuberculosis cases at the monthly intervals of 1, 2 & 3 month under Directly Observed Treatment, Short Course (DOTS) regimen. Lung India 2008;25(3):118-123.

10. Caetano Mota P, Carvalho A, Valente I et al. Predictors of delayed sputum smear and culture conversion among a Portuguese population with pulmonary tuberculosis. Revista Portuguesa de Pneumologia. 2012; 18(2):72-79.

11. Nwokeukwu H.I, Awujo D N and Emma Ukeagbu U. Association of sputum conversion and outcome with initial smear grading among new smear positive tuberculosis patients in a tertiary health facility, South east zone. IOSR Journal of Dental and Medical Sciences 2013;4(6): 4-9.

12. Khalid Bouti, Mohammed Aharmim, Karima Marc, Mouna Soualhi et al. Factors Influencing Sputum Conversion among Smear-Positive Pulmonary Tuberculosis Patients in Morocco. ISRN pulmonology 2013; 1-5.

13. Aylin Babalik, Sule kiziltas, Hulya Arda et al. Factors affecting smear conversion in tuberculosis management. Medicine Science 2012; (4):351-62.