

## Value of chest X-ray in diagnosis of smear negative pulmonary tuberculosis

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### Abstract

**Background:** Early diagnosis and so the treatment is of great value in pulmonary tuberculosis.

**Objective:** To determine the value of chest x-ray in diagnosis of smear negative pulmonary TB patients.

**Study Settings:** This descriptive case series study was undertaken in Department of Pathology Quaid e Azam Medical College in collaboration with outpatient department of Bahawal victoria Hospital Bahawalpur during June 2017 to March 2018.

**Methodology:** After taking the informed consent patients at the time of registration for ATT were recruited and data was collected on a predesigned questionnaire. Demographic characteristics including age, gender, socio-economic status, education and history of smoking, addiction or contact was noted. All the patients were then sent to radiology for chest X-ray postero-anterior (PA) view. Radiologist provided the report of x-ray and results were noted further patients were followed for two month and response to ATT was noted by clinical assessment of patients which was used as gold standard. Data was analyzed by using SPSS 20.

**Results:** A total of 187 pulmonary TB patients including 127 (67.9%) smear negative and 60 (32.1%) smear positive patients with 101(54%) males and 86 (46%) females were included in present study. Radiological features of TB patients showed more mild to moderate lesions among smear negative TB while moderate to severe lesions were found in smear positive patients. Unilateral infiltration was found to be more prevalent among smear negative while bilateral infection, infiltration and cavitation remained high among smear positive TB patients. All the patients were registered for ATT and followed for two months and good response was observed and found to be 96.67% among smear positive and 92.91% among smear negative patients. Two of smear positive and nine smear negative patients did not respond to ATT. Sensitivity, PPV and accuracy of the x-radiograph was calculated and found to be 96.87%, 91.34% and 91.34%.

**Conclusion:** Treatment on the basis of chest radiograph among smear negative pulmonary TB patients was found to be much effective with good treatment outcomes

**Keywords:** Tuberculosis, Diagnosis, Chest x-ray, Anti tubercular treatment.

### Introduction

Tuberculosis (TB) is responsible for a high number of demises and illnesses in under developed countries around the world.<sup>1</sup> Disease is caused by different species of *Mycobacterium (M.)* collectively known as *M. tuberculosis complex (MTC)*.<sup>2</sup> This contagious disease is foremost single infectious agent attributing plenty of deaths<sup>1</sup>. Organism has been survived through 70,000 years and currently infecting two billion people globally.<sup>3</sup> According to World Health Organization (WHO), Pakistan stands amongst the 20 highest burden countries carrying about 87% load of total TB cases around the world. Total new TB cases with active infection are reported to be 525000 while mortality rate of 28 and incidence of 267 per 100000 population of country.<sup>1</sup>

Early diagnosis is the main key for prompt treatment and control of TB; thus prevents its transmission to healthy individuals.<sup>3</sup> Simple test for diagnosis is smear microscopy of sputum stained by Zhiel Neelsen (ZN)

method being used in most of the developing countries. Fluorescent microscopy uses Auramine staining of smear has improved the sensitivity but desired outcomes could not be achieved.<sup>4</sup> Both methods used to observe the presence of acid fast bacilli (AFB) in the smear under microscope. Smear microscopy is cheap, easy to perform and rapid method of diagnosis<sup>5</sup> but requires high number of bacilli per ml of sputum therefore sensitivity has been reported to be as low as 55-70% in various studies.<sup>6</sup>

Culture for MTC on Lowenstein Jensen (LJ) medium is gold standard and a very sensitive, specific and keeps the ability to detect even few bacilli if present in the specimen.<sup>7</sup> This test requires various sensitive protocols to deal with live bacilli, 4-8 weeks long period of incubation with provision of limited facilities countrywide. GeneXpert on the other hand a modern and rapid diagnostic tool has increased its importance in diagnosis of drug resistant TB and playing its role in meeting challenge but could not be used for basic screening.<sup>8</sup> Bacteriological confirmation is important though diagnosis on clinical grounds and radiological

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suspicion has already provoked the clinicians to start anti TB treatment of smear and/or culture negative tuberculosis since two decades or so.<sup>9</sup> Obviously AFB smear positive TB patients are more infectious and spread the bacilli many folds high as compared to smear negative pulmonary TB patients. In any case smear positive TB patients are in the position to start ATT but smear negative TB patients remain under an uncertain condition until to become smear positive or physician may remain on trying variety of medicine. Clinical signs and symptoms and positive history of TB contact in combination of chest X-ray become more important in diagnosis of such cases. Moreover chest x-ray is also important in cases where history of contact is not determined. Therefore objective of this study was to determine the value of chest x-ray in diagnosis of smear negative pulmonary TB patients.

## Methodology

This descriptive case series study was undertaken in Department of Pathology Quaid e Azam Medical College in collaboration with outpatient department of Bahawal victoria Hospital Bahawalpur during June 2017 to March 2018. A total of 127 smear negative patients were calculated by taking confidence level of 95%, precision as 8% and expected prevalence of smear negative pulmonary tuberculosis as 30%. Sample size was brought to 187 by adding 60 patients of smear positive pulmonary tuberculosis which served as confirmed TB positive control cases. Non probability convenient sampling technique was used to collect the patients. All new pulmonary smear positive and negative pulmonary TB patients were recruited to achieve the desired number consecutively. Patients with history of anti-tubercular treatment (ATT), treatment failure and/or relapse were not included in this study.

After taking the informed consent patients at the time of registration for ATT were recruited and data was collected on a predesigned questionnaire. Demographic characteristics including age, gender, socio-economic status, education and history of smoking, addiction or contact was noted. All the patients were then sent to radiology for chest X-ray postero-anterior (PA) view. Radiologist provided the report of x-ray and results were noted further patients were followed for two month and response to ATT was noted by clinical assessment of patients which was used as gold standard. Data was entered and analyzed by using SPSS 20. Qualitative variables like Gender and other demographic characteristics were presented as frequency and percentages while qualitative data like age was presented as mean  $\pm$  standard deviation. Sensitivity, positive predictive value, and accuracy were calculated by taking response to ATT as gold standard.

## Results

A total of 187 pulmonary TB patients including 127 (67.9%) smear negative and 60 (32.1%) smear positive patients were observed in present study. There were 101(54%) males and 86 (46%) females with a female to male ratio of 1:1.18 participated in present study. Mean age of patients remained  $36 \pm 12.8$  years.

Most of the 47.6% patients were having primary or low education, 62.6% had poor socio-economic status while 62% had an established history of contact of other TB patients before acquiring infection. Important signs including fever, cough, weight loss and anorexia were noted to be 94.1%, 92.5%, 98.4% and 88.3% respectively. Other characteristics of patients are presented in table I.

**Table I: Demographic Characteristics of Patients**

Characteristics		Smear Negative (N=127)		Smear Positive (N=60)		Total (N=187)	
		n	%	n	%	n	%
Gender	Male	70	55.2	31	51.7	101	54.0
	Female	57	44.8	29	48.3	86	46.0
Education (Years)	0-5	60	47.3	29	48.3	89	47.6
	6-10	48	37.8	24	40.0	72	38.5
	$\geq 11$	19	14.9	7	11.7	26	13.9
Socio-economic Status	Poor	81	63.8	36	60.0	117	62.6
	Middle	30	23.6	17	28.3	47	25.2
	Upper Middle	16	12.6	7	11.7	23	12.2
Sign and Symptoms*	Fever	116	91.4	60	100	176	94.1
	Cough	113	89.0	60	100	173	92.5
	Weight Loss	124	97.6	60	100	184	98.4
	Anorexia	107	84.3	58	96.7	165	88.3
History of TB Contact	Established	78	61.4	38	63.3	116	62.0
	Not Established	49	38.6	22	36.7	71	38.0
History of Smoking		51	40.2	27	45.0	78	41.7
History of other addiction		4	3.2	2	3.0	6	3.2

\*Each patient may or may not have more than one symptom.

Radiological features of TB patients showed more mild to moderate lesions among smear negative TB while moderate to severe lesions were found in smear positive patients. Unilateral infiltration was found to be more prevalent among smear negative while bilateral infection, infiltration and cavitation remained high among smear positive TB patients. Results with different angles of radiographs are shown in table II.

All the patients were registered for ATT and followed for two months and good response was observed and found to be 96.67% among smear positive and 92.91% among smear negative patients. Two of smear positive and nine smear negative patients did not respond to ATT. Sensitivity, PPV and accuracy of the x-radiograph was calculated and found to be 96.87%, 91.34% and 91.34%. Specificity and NPV could not be calculated due to absence of TB disease negative group.

Table II: Radiological Features of Patients

Radiological Features		Smear Negative (N=127)		Smear Positive (N=60)		Total (N=187)	
		n	%	n	%	n	%
Lung Affected	Bilateral	31	24.4	37	61.6	68	36.4
	Unilateral	96	75.6	23	38.4	119	63.6
Lung Side	Left	45	35.5	9	15.0	54	28.9
	Right	54	42.5	14	23.4	68	36.4
	Both	28	22.0	37	61.6	65	34.7
Lobe Affected	Upper	26	20.5	7	11.6	33	17.6
	Middle	33	26.0	11	18.4	44	23.5
	Lower	39	30.7	15	25.0	54	28.9
	Upper & Middle	6	4.7	3	5.0	9	4.8
	Upper & Lower	6	4.7	4	6.6	10	5.4
	Middle & Lower	8	6.3	9	15.0	16	8.6
	Upper Middle & Lower	9	7.1	11	18.4	20	10.7
Type of Lesion	Consolidation	17	13.4	8	13.3	25	13.4
	Infiltration	106	83.5	25	41.7	131	70.0
	Cavitation	4	3.1	27	45.0	31	16.6
Severity of Lesion	Mild	110	86.6	4	6.7	114	61.0
	Moderate	15	11.8	24	40.0	39	20.8
	Extensive	2	1.6	32	53.3	34	18.2

## Discussion

Smear negative patients on the basis of radiological findings were given ATT in present study are in accordance with a previous study for the betterment of patients.<sup>11</sup> It is obvious to wait for culture results up to 6-8 weeks cause considerable delay in starting treatment though facilities of culture are also not readily available and are compromised in due to many organizational and management factors.<sup>12</sup> On the other hand smear negative TB patients although less infectious but are capable of disease transmission.<sup>13</sup>

Various radiological features were studied in present study including bilateral and unilateral infections. Bilateral infections were frequent in smear positive TB patients and found to be 61.6% very high as compared to smear negative patients who showed bilateral infection among only 24.4% patients. Similarly 83.5% smear negative cases showed infiltration and presented mild infection

among 86.6% smear negative patients while cavitation was found to be as high as 45% of smear positive patients and 53.3% showed extensive lesions. A previous study from Lahore has shown a bit different findings that presented 64% diffused infiltration and 24% extensive & cavitatory lesions among smear negative TB patients.<sup>11</sup>

A good treatment response was observed and found to be 96.67% among smear positive and 92.91% among smear negative patients with an overall sensitivity of chest x-ray for diagnosing pulmonary TB as 96.87% in present study. World Health Organization has also endorsed that x-ray is a valuable tool for identification of TB as differential diagnosis and has good sensitivity.<sup>14</sup> Another study has also revealed the good treatment outcome of 97% among bacteriologically confirmed TB cases and lower rate of 81% among bacteriologically negative while x-ray confirmed TB cases<sup>11</sup> and in accordance with present study. An older study however has reported a treatment response of only 78% among radio-logically confirmed TB cases is much lower than present results.<sup>15</sup>

Early diagnosis of smear negative TB is a great challenge and need special attention in developing countries contained high burden of disease. Association of lower mortality has been indicated by an early detection and treatment of smear negative TB cases in United states.<sup>16</sup> Developing countries are face low quality TB laboratory services with high burden of pulmonary tuberculosis though absence of smear positive TB reports at primary care level enforce the physicians to diagnose the disease using chest radiographs and clinical indicators.<sup>17</sup>

## Conclusion

In conclusion, it is shown that treatment on the basis of chest radiograph among smear negative pulmonary TB patients was found to be much effective with good treatment outcomes. It is therefore highlighted that proper diagnosis need prompt decisions on the basis of proper history, clinical assessment and chest x-ray beside the smear result and further monitoring increase the batter outcomes in terms of treatment success and early control of disease.

**Authors Contribution:** MAM: Conception, drafting and final approval. SZ : Analysis, drafting and final approval. NR: Analysis, drafting and final approval. SA : Analysis, drafting and final approval

**MIS:** Interpretation, drafting and final approval.

**SK:** Analysis, drafting and final approval.

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