

# Comprehensive Evaluation Of Patient Characteristics And Clinical Parameters As A Diagnostic Aid In Tuberculosis

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## Abstract

**Background & objectives:** Tuberculosis is a social disease with medical implications. A presumptive diagnosis of tuberculosis sometimes can be made on basis of patient's medical history, clinical and radiological findings. It may also include a tuberculin skin test and a serological test. Hence this study was carried out to study the feasibility of various patient characteristics and clinical parameters as a diagnostic aid in tuberculosis. **Methods:** This prospective study was conducted over a period of one year (1<sup>st</sup> August 2009 to 31<sup>st</sup> July 2010) in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana. From 269 suspected cases of tuberculosis admitted in various wards and ICUs, 300 pulmonary and extra-pulmonary samples were received. The patients were diagnosed as suffering from tuberculosis after Auramine staining and culture on Mycobacteria Growth Indicator Tube (MGIT). **Results:** Majority of the cases were in the age group of 45-64 years. Male: female ratio of 3.33:1. Among the subjects with pulmonary tuberculosis, cough with expectoration (74.19%) was the commonest complaint, whereas among the subjects with extra-pulmonary tuberculosis fever and breathlessness (37.50%) each were common. Among positive cases, consolidation (48.73%) was the most common X-Ray finding followed by pleural effusion (7.69%), whereas in negative cases, consolidation was seen in only 0.43% and pleural effusion in only 0.87% of cases. The mean induration of  $16.28 \pm 3.95$  mm was seen in the positive cases while the mean induration of  $6.51 \pm 3.96$  mm was observed in the negative cases on Mantoux testing. The positive cases had mean ESR (Erythrocyte Sedimentation Rate) of  $66.86 \pm 20.98$  mm/hr while the negative cases had mean ESR value of  $16.21 \pm 5.48$  mm/hr. The mean haemoglobin (Hb), value in the positive cases was  $11.74 \pm 1.82$  g% while the mean haemoglobin value in the negative cases was  $11.85 \pm 1.70$  g%. The positive cases had mean TLC (Total Leucocyte Count) of  $7.40 \pm 2.62 \times 10^9/L$  while the others had mean of  $7.35 \pm 4.84 \times 10^9/L$ . Out of the 269 subjects, 187 were immunized with the BCG vaccine and 82 were non-immunized. **Interpretation & conclusions:** Among the various laboratory parameters studied, Mantoux test and ESR values were found to be significantly raised in patients with tuberculosis.

## INTRODUCTION

Tuberculosis, one of the oldest recorded human afflictions, is still one of the biggest killers among the infectious diseases, despite the worldwide use of a live attenuated vaccine and several antibiotics.<sup>[1]</sup> Tuberculosis, as yet, is far from being controlled. Tuberculosis is a social disease with medical implications. TB affects more than eight million people every year and has serious repercussions on economy, as well as the psychologic and social status of the affected individuals. It has therefore been declared a global emergency in 1993 by World Health Organization (WHO).<sup>[2]</sup>

Two decades ago, it was thought that TB was under control and that it was a matter of time before it would be eradicated. Today, this disease has reestablished itself due to several factors. The lack of drug compliance, the appearance of multiple-drug resistant strains, and the AIDS epidemic are a few factors that have led to the resurgence of TB.<sup>[3]</sup>

A presumptive diagnosis of tuberculosis sometimes can be made on basis of patient's medical history, clinical and radiological findings. It may also include a tuberculin skin test and a serological test. The primary clinics where most patients with symptoms of TB first seek care rarely have AFB microscopy available, and patients have to wait until they are referred to a specialty clinic or microscopy center.<sup>[4]</sup>

Hence this study was carried out to study the feasibility of various patient characteristics and clinical parameters as a diagnostic aid in tuberculosis.

## MATERIAL AND METHODS

This prospective study was conducted over a period of one year (1<sup>st</sup> August 2009 to 31<sup>st</sup> July 2010) in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana. From 269 suspected cases of tuberculosis admitted in various wards and ICUs, 300 pulmonary and

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extra-pulmonary samples were received. The samples were processed by standard microbiological techniques. The patients were diagnosed as suffering from tuberculosis after Auramine staining and culture in MGIT.

The following data was collected from all the patients: name, age, sex, CR number, specimen and lab ID number, clinical history, Haemoglobin (Hb), Total Leukocyte Count (TLC), Differential Leukocyte Count (DLC), ESR (Erythrocyte Sedimentation Rate), Mantoux test, history of BCG vaccination and Chest X-Ray findings. A comparison was made with reference to the negative cases. Further, we analysed the utility of the above parameters as a diagnostic aid in tuberculosis.

### RESULTS

**Figure 1**

Table 1: Age-wise Distribution of Subjects

Age (years)	Positive cases (n=39)	Negative Cases (n=230)
1-14	1 (2.56)	1 (0.43)
15-24	1 (2.56)	16 (6.96)
25-34	1 (2.56)	45 (19.57)
35-44	7 (17.95)	39 (16.96)
45-54	9 (23.08)	50 (21.74)
55-64	11 (28.21)	48 (20.86)
Above 65	9 (23.08)	31 (13.48)

Figures in parentheses indicate percentages

Table 1 shows the age-wise distribution of the subjects. Majority of the cases were in the age group of 45-64 years. Out of the 39 positive cases, the majority of the subjects (28.21%) were in the age group of 55-64 years. Out of the 230 negative cases, 50(21.74%) were in the age group of 45-54 years.

**Figure 2**

Table 2: Sex-wise Distribution of Subjects

Sex	Positive Cases (n = 39)	Negative Cases (n = 230)
Male	30 (76.92)	145 (63.04)
Female	9 (23.08)	85 (36.96)
p= 0.0981		

Figures in parentheses indicate percentages

Out of the 39 positive cases, 30 (76.92%) were males and 9 (23.08%) were females with a male: female ratio of 3.33:1. Out of the 230 negative cases, 145 (63.04%) were males and 85 (36.96%) were females. The male: female ratio was 1.71:1. The difference between the positive and negative cases among males and females was found to be statistically non-significant (p= 0.0981).

**Figure 3**

Table3: Symptoms in Subjects (n=39) with Pulmonary & Extra-pulmonary Tuberculosis

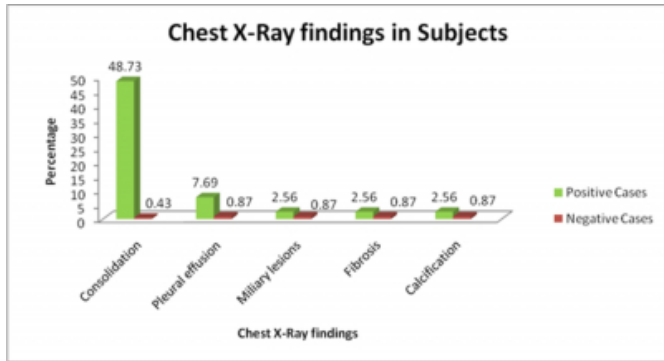
Symptoms	Pulmonary Cases (n=31)	Extra-Pulmonary Cases (n=8)	p -Value
Cough with expectoration	23 (74.19)	0	-
Fever	20 (64.52)	3 (37.50)	0.1191
Loss of weight	19 (61.29)	2 (25.00)	0.0898
Loss of appetite	17 (54.84)	1 (12.50)	0.0457
Fatigue	15 (48.39)	0	-
Breathlessness	14 (45.16)	3 (37.50)	0.4235
Chest pain	13 (41.94)	0	-
Haemoptysis	9 (29.03)	0	-
Swelling ( Hip joint/ Neck lymph nodes)	0	2 (25.00)	-
Discharge (Abdominal wound)	0	1 (12.50)	-
Decreased joint movement	0	1 (12.50)	-

Figures in parentheses indicate percentages

Among the subjects with pulmonary tuberculosis, cough with expectoration (74.19%) was the commonest complaint, followed by fever (64.52%), loss of weight (61.29%) and loss of appetite (54.84%); whereas among the subjects with extra-pulmonary tuberculosis fever and breathlessness (37.50%) each were common.

**Figure 4**

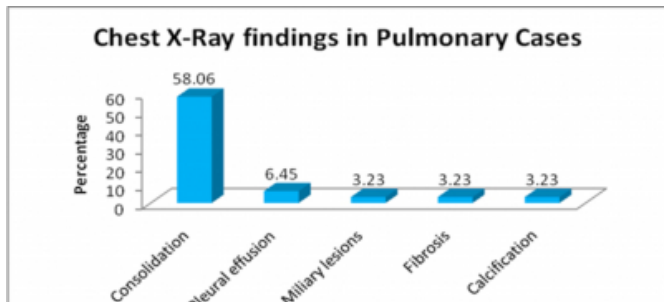
Figure 1



The majority of the negative cases had normal Chest X-Ray (96.53%) while only 35.90% of the positive cases had normal Chest X-Ray. Among positive cases, consolidation (48.73%) was the most common X-Ray finding followed by pleural effusion (7.69%), whereas in negative cases, consolidation was seen in only 0.43% and pleural effusion in only 0.87% of cases.

**Figure 5**

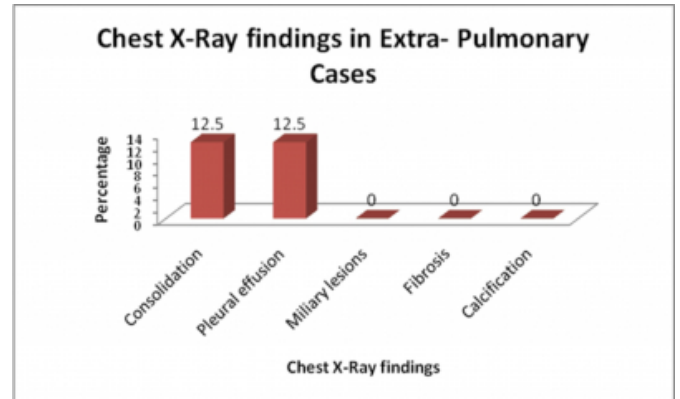
Figure 2



Among the cases with pulmonary tuberculosis, consolidation (58.06%) was the most common finding while pleural effusion was seen in 6.45% of the cases. Normal Chest X-Ray was seen in 25.80% of the pulmonary cases.

**Figure 6**

Figure 3



Among the cases with extra-pulmonary tuberculosis, consolidation and pleural effusion was observed in 12.5% each of the cases. Normal Chest X-Ray was seen in 75% of the extra-pulmonary cases.

**Figure 7**

Table 4: Comparison of various other laboratory parameters

Parameters	Positive Cases	Negative Cases	p-Value
Mantoux Test (Induration in mm)	16.28 ± 3.95	6.51 ± 3.96	0.0004
Mean ESR (mm/hr)	66.86 ± 20.98	16.21 ± 5.48	0.0001
Mean Hb (g%)	11.74 ± 1.82	11.85 ± 1.70	0.4230
Mean TLC (10 <sup>9</sup> /L)	7.40 ± 2.62	7.35 ± 4.84	0.9125

Various laboratory parameters of the positive cases and the negative cases were compared. The mean induration of 16.28 ± 3.95 mm was seen in the positive cases while the mean induration of 6.51 ± 3.96 mm was observed in the negative cases on Mantoux testing. The difference between the mean induration of the positive and negative cases was found to be statistically significant (p= 0.0004).

The positive cases had mean ESR (Erythrocyte Sedimentation Rate) of 66.86 ± 20.98 mm/hr while the negative cases had mean ESR value of 16.21 ± 5.48 mm/hr. The difference between the mean ESR values of the positive and negative cases was statistically significant (p= 0.0001).

The mean haemoglobin value in the positive cases was 11.74 ± 1.82 g% while the mean haemoglobin value in the negative cases was 11.85 ± 1.70 g%. The difference between

the mean haemoglobin values of positive and negative cases was statistically non-significant ( $p= 0.4230$ ).

The positive cases had mean TLC (Total Leucocyte Count) of  $7.40 \pm 2.62 \times 10^9/L$  while the others had mean of  $7.35 \pm 4.84 \times 10^9/L$ . The difference between mean TLC values of positive and negative cases was statistically non-significant ( $p= 0.9125$ ).

Out of the 269 subjects, 187 were immunized with the BCG vaccine and 82 were non-immunized. Out of these 187 immunized subjects, 16 (8.56%) still developed tuberculosis. Thereby the protective efficacy of BCG vaccine was found out to be 91.44%.

## **DISCUSSION**

TB imposes a tremendous economic and social burden on societies, communities and individuals of all ages and in all social classes.<sup>[5]</sup> In a study conducted in the Netherlands on diagnosed cases of tuberculosis, the majority of the patients were males (65%) and the average age at presentation was 42 years.<sup>[6]</sup> Gustafson et al. also found that male sex and increasing age were significant risk factors for TB.<sup>[7]</sup> In our study, majority of the patients diagnosed with tuberculosis belonged to the older age groups of 45-54 & 55-64 years and males (76.92%) were more affected by tuberculosis than females (23.1%).

A South Indian survey on 136947 persons of all ages had reported a substantially higher male prevalence and male: female ratio of 5.5:1 for all ages combined.<sup>[7]</sup> Higher male: female prevalence ratio of 3.3:1 was observed in our study and was found to be similar to a study carried out in Gambia which reported a ratio of 3.5:1 whereas Baboolal et al. had reported male: female ratio of 4:1.<sup>[8,9]</sup>

Although TB can affect any organ system, it mainly involves the respiratory system. Mexican Institute of Public Health reported cough with expectoration in 73.3% patients.<sup>[10]</sup> Similar results had also been reported from Tiruvallur, Tamilnadu. Cough was the most common symptom (79.1%).<sup>[11]</sup> The American Thoracic Society in its official statement had also stated cough to be the most common manifestation of pulmonary tuberculosis.<sup>[12]</sup> In our study also, cough with expectoration (74.19%) was the most common presenting complaint in the patients of pulmonary TB cases followed by fever and weight loss.

As far as extra-pulmonary tuberculosis is concerned, pyrexia of unknown origin (PUO) had been reported to be the only

diagnostic clue in many cases. Patients also had other constitutional symptoms such as anorexia, weight loss, malaise and fatigue.<sup>[13]</sup> The American Thoracic Society had also stated that manifestations of extra-pulmonary tuberculosis are varied depending on the site involved.<sup>[12]</sup> In our study, one of the most common presenting complaints was fever (37.5%) followed by chest pain, breathlessness, loss of weight and appetite, joint/ neck swelling, persistent abdominal wound discharge and decreased joint movements.

Chest radiography can give timely indications and plays an important role in the clinical diagnosis of pulmonary TB. Culture positive pulmonary TB with a normal CXR is not uncommon, and that patients with this presentation are typically symptomatic or are found during contact tracing of infectious TB.<sup>[14]</sup> Normal chest X-ray was seen in 25.8% of pulmonary cases in our study. In patients with pulmonary tuberculosis, consolidation (58.6%) was the most common radiographic finding followed by pleural effusion (6.45%). The findings were consistent with those of a study conducted in Taipei which reported consolidation in 68.54% and effusion in 12.36% of cases.<sup>[15]</sup>

Delayed hypersensitivity is used as an aid in the diagnosis of tuberculosis. Though it has been reported that in a developing country like India, where there is extensive coverage of BCG, it seems that tuberculin test has lost its sensitivity as an indicator for the true prevalence of infection.<sup>[16]</sup> A study carried out in Karachi had reported the average induration of 15 mm and 5 mm in the patients having tuberculosis as compared to others.<sup>[17]</sup> Similar results were found in our study. The average induration obtained was 16.28 mm in the cases positive for tuberculosis as compared to 6.51 mm in the other patients. Thus Mantoux test provides good supportive evidence of active tuberculosis.

ESR is a nonspecific marker of inflammation and is elevated in a number of infectious and noninfectious conditions. The rise in ESR had been documented by Hasan et al.<sup>[18]</sup> whereas Infectious Disease Hospital, Nigeria demonstrated only a marginal rise in ESR.<sup>[19]</sup> In a study conducted in Pakistan the values of ESR were found to be 64.3 mm/hr and 16.57 mm/hr in the case and control groups.<sup>[20]</sup> We also found the ESR value to be significantly raised in the tuberculosis patients, being 66.86 mm/hr, while in the rest of the cases, it was 16.21 mm/hr.

Anemia is a common hematological abnormality in patients

with TB. It has also been seen that there is multifactorial causation of anaemia and that anaemia cannot be solely attributed to tuberculosis. In our study no significant difference was noted in the average haemoglobin levels of tuberculosis patients ( $11.74 \pm 1.82$  g%) and other patients ( $11.85 \pm 1.70$  g%). The findings were in agreement with other studies which state a very high prevalence of anaemia in India.<sup>[21]</sup> However, our findings were in contrast to another study which showed a significantly lower level of haemoglobin ( $8.84 \pm 2.33$  g%) in tuberculosis patients as compared to others ( $11.8 \pm 1.65$  g%).<sup>[20]</sup>

Various other laboratory parameters had been studied in tuberculosis patients. A study had documented mild leucocytosis in tuberculosis patients but had stated that the association was non-significant.<sup>[22]</sup> In our study, there was no significant association of TLC and DLC parameters between tuberculosis patients and others similar to a Pakistani study which stated a non-significant difference in these parameters in the tuberculosis patients and others.<sup>[20]</sup>

In studies from India, the protective efficacy of BCG immunisation has not been high and the results are conflicting. It has been postulated that other risk factors such as poor nutrition, low standard of living and exposure to a high infective dose of the bacilli from a household contact may overcome the protective effect of BCG in the Indian population.<sup>[23]</sup> The Indian Council for Medical Research also observed that BCG has little effect on preventing bacillary forms of tuberculosis.<sup>[24]</sup> Whereas Colditz et al. stated that on an average, BCG vaccine significantly reduces the risk of TB by 50%.<sup>[25]</sup> We found out that the percentage of subjects protected against tuberculosis by BCG vaccination was 91.44% while 8.56% of the subjects developed tuberculosis despite BCG vaccination. The findings were consistent with various studies carried out worldwide which show the range of protection offered by BCG varies from 0 to 85%.<sup>[26]</sup>

Among the various laboratory parameters studied, Mantoux test and ESR values were found to be significantly raised in patients with tuberculosis.

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