

# Study of Hematological and Biochemical Parameters in Pulmonary Tuberculosis

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**Abstract:** Background: Tuberculosis is a major public health problem in India having variety of hematological manifestations. Reversible peripheral blood abnormalities are commonly associated with pulmonary tuberculosis. Aims and Objectives: To investigate the changes of hematological and biochemical parameters in patients affected with pulmonary tuberculosis. Materials and Methods: 78 patients of pulmonary tuberculosis were included in the study who were sputum positive or diagnosed through chest x-ray findings. Patients who were known case of AIDS or on ATT were excluded from the study. Results: Out of 78 cases of pulmonary tuberculosis 79.48% (62) patients were male and 21.79% (16) patients were female. Anemia was seen in 69.2% (54), severe anemia was seen in 7.69% (6). Our study noted raised ESR in 49 cases (62.8%). Leukocytosis was seen among 38.4% (30) patients among which 73.3% (22) and 26.66% (8) were male and female respectively. Thrombocytopenia was seen among 11.5% and thrombocytosis was seen in 11.5%. Hyponatremia and hypokalemia was observed in 77% (47) and 22.9% (14) respectively. Conclusion: Some hematological and biochemical findings in our study are consistent with previous studies like anemia, ESR and hyponatremia, other parameters like pancytopenia, platelet changes in isolation, altered renal function and hypokalemia may require further evaluation to find out the association with tuberculosis. When there is a clinical suspicion of tuberculosis but without confirmatory evidences in the form of chest x-ray, tissue biopsy and sputum, these hematological and biochemical changes in combination may help in narrowing down the diagnosis. However further studies are needed to find out correlation between hematological, biochemical and clinical parameters in managing tuberculosis.

**Keywords:** Tuberculosis, anemia, platelets, hyponatremia, hypokalemia

## 1. Introduction

Tuberculosis is a highly prevalent chronic infectious disease caused by Mycobacterium tuberculosis bacilli. Globally Mycobacterium tuberculosis infection remains at an epidemic level affecting one third of world population<sup>1</sup>. The condition in India is equally alarming. About one third of India population is infected with Mycobacterium tuberculosis<sup>2</sup>. The following people are at high risk for active tuberculosis elderly, infants and people with weakened immune system, for instance, AIDS. The risk for contracting tuberculosis increases if one is in frequent contact with people living with the disease, poor nutrition and living in crowded or unsanitary living condition<sup>3</sup>.

Hematopoietic system is another organ seriously affected by tuberculosis<sup>4</sup>. Reversible peripheral blood abnormalities are commonly associated with pulmonary tuberculosis. Insight into the relationship between hematological abnormalities and mycobacterial infection has come from an understanding of the immunology of mycobacterial infection. The atypical and varied spectrum of clinical presentation of tuberculosis poses a diagnostic and therapeutic challenge to the physicians. Little is known about the prevalence of these hematological abnormalities and the effect of anti-tuberculosis treatment on the various hematological parameters in the Indian subcontinent<sup>5</sup>.

This study was undertaken to analyse the hematological and biochemical parameters in patients with sputum smear positive for AFB and to evaluate their diagnostic and prognostic significance.

## 2. Materials and Methods

The study subjects include 78 pulmonary tuberculosis patients diagnosed either through sputum examination or chest x-ray findings from

### Inclusion Criteria

- Newly diagnosed pulmonary tuberculosis patients.
- Patients above 16 years.

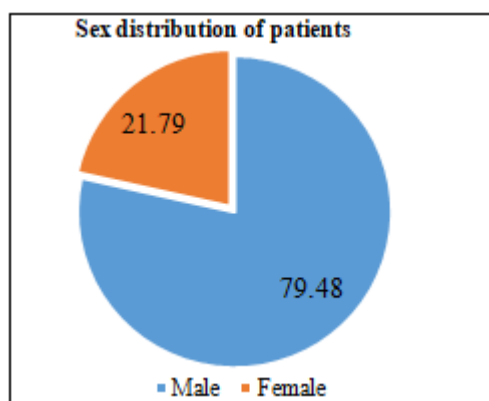
### Exclusion Criteria

- Patients less than 16 years' age
- AIDS patients
- Extra pulmonary tuberculosis cases
- Patients with past history of tuberculosis or receiving ATT drugs.

For hematological and biochemical analysis, about 4-6 ml peripheral venous blood was drawn aseptically with the help of sterile syringe. 2ml was transferred into a tube containing 0.2ml of 4% ethylene diamine tetra acetic acid (EDTA) solution and analyzed in the hematology analyzer for evaluation of different blood parameters. The remaining 2 ml blood was used for erythrocytic sedimentation rate (ESR) determination. Approximately 02 ml of the anticoagulant added blood was drawn into Westergen tube up to the mark. The tube was placed in a stand vertically for one hour and the readings were recorded.

### 3. Results

78 patients of pulmonary tuberculosis were included in the study who were sputum positive or diagnosed through chest x-ray findings. Out of 78 patients 79.48% (62) patients were male and 21.79% (16) patients were female.



**Figure 1:** Sex distribution of patients

**Table 1:** (Age distribution of patients)

Age in years	Males	Females
<20	0	2
21-30	4	1
31-40	9	3
41-50	11	4
51-60	15	0
61-70	12	3
>71	11	3

**Table 2:** Distribution of hemoglobin concentrations in patients with tuberculosis  
 Hemoglobin concentration:

Hemoglobin concentration	Number of patients
<6	7.69%(6)
6.1-9	14.1%(11)
9.1-12	47.4%(37)
>12	30.7%(24)

**Table 3:** ESR in patients with pulmonary TB  
 Erythrocyte sedimentation rate:

	Normal ESR	Raised ESR
Male	7.40%(4)	77.7%(42)
Female	1.85%(1)	12.9%(7)

**Table 4:** Leukocytosis in patients with pulmonary TB  
 Leukocytes:

The WBC count presented variable features. Leukocytosis was seen among 38.4% (30) patients among which 73.3% (22) and 26.66% (8) were male and female respectively.

Male	73.3%(22)
Female	26.66%(8)

Leucopenia was observed among 5.1% (4) patients.

**Table 5:** platelet distribution in patients with pulmonary TB  
 Platelets:

Thrombocytopenia	11.5%(9)
Thrombocytosis	11.5%(9)

**Table 6:** Biochemical parameters in patients with pulmonary TB

Biochemical parameters:	
Hyponatremia	77.0%(47)
Hypokalemia	22.9%(14)
Hyponatremia and hypokalemia	24.5%(15)
Raised creatinine	8

### 4. Discussion

In our study involving 78 subjects, males comprised 62 (79.48%) and females 16 (21.79%). Other studies which also had male predominance was Molay Banerjee et al<sup>6</sup> and Yaranal et al<sup>7</sup>

Out of 78 cases, 54 patients (69.2%) had anemia. A study conducted by Yaranal et al<sup>7</sup> had anemia in 74% cases. A study by M.Banerjee et al<sup>6</sup> noted anemia in 68.28% cases. Our study showed 37 cases of Hb between 9-12 gm% this is similar to results observed in studies by M.Banerjee et al<sup>6</sup> (44.49% had Hb between 8-11 gm%). Other study showing Hb between 8-11 gm% was Yaranal et al<sup>7</sup> (39% cases). Studies by KJ Singh et al found blunted erythropoietin response of bone marrow<sup>2</sup>. Tumor necrosis factor- $\alpha$  and other cytokines released by activated monocytes suppress the erythropoietin production leading to anemia<sup>2</sup>.

Our study noted pancytopenia in 2 cases, previous studies state pancytopenia a rare finding in PTB<sup>8</sup>. Yaranal et al noted pancytopenia in 2 cases<sup>7</sup>. Puri MM et al noted a case of pancytopenia in tuberculosis<sup>9</sup>. The cause for pancytopenia include splenic sequestration, immune mediated bone marrow suppression and decreased bone marrow reserve<sup>7</sup>.

A rare presentation seen in the elderly is cryptic military TB that has a chronic course characterized by mild intermittent fever, anemia and ultimately meningeal involvement preceding to death. An acute septicemic form, non-reactive military TB, occurs very rarely and is due to massive hematogenous dissemination of tubercle bacilli. Pancytopenia is common in this form of disease, which is rapidly fatal. At postmortem examination, multiple necrotic but nongranulomatous (nonreactive) lesions are detected<sup>14</sup>.

Our study noted raised ESR in 49 cases (62.8%). Normal ESR in males <10mm/hr and in females <20mm/hr. Yaranal et al noted raised ESR in 99% cases<sup>7</sup>. Banerjee et al noted raised ESR in 98.23% cases<sup>6</sup>. The ESR are useful practical method of obtaining accurate and dependable information about the actual progress or retrogression of TB lesions, before these can be demonstrated by other clinical and lab procedures. Changes in ESR parallel alteration in tuberculous focus<sup>7</sup>. Previous studies have documented an elevated ESR level in majority of patient which decreased in those whose sputum becomes negative<sup>2</sup>.

Our study noted thrombocytopenia in 11.5%. Yaranal et al noted thrombocytopenia in 9% cases<sup>7</sup>. M Banerjee et al noted thrombocytopenia in 5.28% cases<sup>6</sup>.

Our study noted thrombocytosis in 11.5% cases. Yaranal et al noted thrombocytosis in 24% cases<sup>7</sup>. Morris et al noted thrombocytosis in 50% cases in PTB<sup>10</sup>. Singh KJ et al noted

thrombocytosis in 32% cases<sup>2</sup>. Banerjee et al<sup>6</sup> noted thrombocytosis in 17.62% cases. The cause for thrombocytosis in PTB is not clear<sup>11</sup>. IL-6 and other mediators may be the cause for thrombocytosis as they promote platelet production<sup>12</sup>.

In 1969 Chung and Hubbard noted nearly 11% of patient with active TB are affected with hyponatremia (SIADH). Vorherr et al reported PTB with hyponatremia and found antidiuretic agents in TB lung tissues<sup>13</sup>

Bryant et al has suggested the SIADH for patient with PTB. Schorn et al; Cockeroff et al reported hyponatremia in tuberculosis. Few studies detected that ADH levels was not detectable following full ATT.

Hypokalemia noted in new TB case when compared with control. Significant decrease in mean potassium levels when new TB patient were compared with TB on drugs and TB co-infection with HIV. The cause is in stress situation, increase catabolism of protein leading to movement of potassium from intracellular compartment to plasma and consequently excreted in urine, sweat, vomiting and compensatory replacement through food.

Various hematological and biochemical abnormalities gradually recover on treating tuberculosis hence unnecessary evaluation and treatment for these changes can be avoided.

## 5. Conclusion

This study shows males are more affected than females. Tuberculosis is associated with various hematological abnormalities like anemia, raised ESR, thrombocytopenia and/or thrombocytosis, pancytopenia. It is also associated with biochemical changes like hyponatremia and hypokalemia. Some hematological and biochemical findings in our study are consistent with previous studies like anemia, ESR and hyponatremia, other parameters like pancytopenia, platelet changes in isolation, altered renal function and hypokalemia may require further evaluation to find out the association with tuberculosis. When there is a clinical suspicion of tuberculosis but without confirmatory evidences in the form of chest x-ray, tissue biopsy and sputum, these hematological and biochemical changes in combination may help in narrowing down the diagnosis. However further studies are needed to find out correlation between hematological, biochemical and clinical parameters in managing tuberculosis.

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