RESEARCH PAPER

Evaluation of Hematological Parameters in Tuberculosis Patients at a Tertiary Care Hospital

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ABSTRACT

Background: Pulmonary tuberculosis continues to be a major public health problem worldwide, particularly in developing countries, where delayed diagnosis and systemic involvement contribute to disease burden. Hematological abnormalities are commonly observed in tuberculosis and may serve as useful indicators of disease activity and severity.

Methods: A hospital-based comparative observational study was conducted at a tertiary care center from August 2025 to January 2026. A total of 80 participants were included, comprising 40 newly diagnosed pulmonary tuberculosis patients and 40 age- and sex-matched healthy controls. Hematological parameters such as hemoglobin, packed cell volume, red blood cell indices, total leukocyte count, differential count, erythrocyte sedimentation rate, and platelet count were analyzed using an automated hematology analyzer. Statistical analysis was performed using appropriate tests, with a p-value of <0.05 considered significant.

Results: Pulmonary tuberculosis patients showed significant hematological alterations compared to controls. The mean hemoglobin level was significantly reduced (9.8 ± 1.6 g/dL vs 12.8 ± 1.4 g/dL), indicating a high prevalence of anemia (80%). Inflammatory markers were markedly elevated, including total leukocyte count ($11,800 \pm 3,200/mm^3$), neutrophil percentage ($72 \pm 8\%$), erythrocyte sedimentation rate (68 ± 18 mm/hr), and platelet count (4.2 ± 1.1 lakh/mm^3), all of which were statistically significant ($p < 0.001$). Elevated ESR (85%) was the most common abnormality, followed by anemia (80%), leukocytosis (65%), neutrophilia (60%), and thrombocytosis (55%). Multivariate analysis revealed that anemia, thrombocytosis, and low body mass index were significantly associated with disease severity.

Conclusion: Pulmonary tuberculosis is associated with significant hematological abnormalities reflecting systemic inflammation and disease severity. Routine hematological parameters, particularly hemoglobin, erythrocyte sedimentation rate, and platelet count, serve as simple and cost-effective markers for diagnosis, severity assessment, and monitoring of tuberculosis.

Keywords: Tuberculosis, pulmonary tuberculosis, hematological parameters, anemia, leukocytosis, thrombocytosis, erythrocyte sedimentation rate, inflammation, disease severity, biomarkers.

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INTRODUCTION

Tuberculosis (TB) remains one of the leading infectious causes of morbidity and mortality worldwide, despite the availability of effective treatment. It is a chronic granulomatous disease with multisystem involvement, predominantly affecting the lungs, and is characterized by complex immunopathological mechanisms that extend beyond localized infection [1]. The disease continues to challenge healthcare systems due to its persistent transmission, delayed diagnosis, and association with socioeconomic determinants.

Pulmonary tuberculosis is the most common and epidemiologically significant form of TB, responsible for the majority of disease transmission. The pathogenesis involves an intricate interaction between *Mycobacterium tuberculosis* and host immune responses, leading to granuloma formation, caseation, and systemic inflammatory changes [2]. According to recent global estimates, approximately 10.6 million new TB cases were reported worldwide, with 1.3 million deaths among HIV-negative individuals, highlighting its continued global impact [3]. These figures underscore the urgent need for improved diagnostic and monitoring strategies.

From a clinical and public health perspective, early detection and effective monitoring of TB are essential to reduce transmission and improve patient outcomes. International health agencies emphasize that timely diagnosis, supported by laboratory investigations, plays a crucial role in disease control [4]. While microbiological confirmation remains the gold standard, adjunct investigations are necessary to assess disease severity, systemic involvement, and response to therapy [5].

Tuberculosis is associated with significant systemic inflammation, which leads to measurable alterations in hematological parameters. These changes reflect both the direct effects of infection and the host immune response [6]. In high-burden countries such as India, which contributes nearly 27% of global TB cases, national programs have prioritized comprehensive evaluation strategies to enhance disease control and achieve elimination targets [7]. Within this framework, hematological parameters offer a practical and cost-effective means of assessing disease status.

Hematological abnormalities are among the most consistent findings in patients with pulmonary tuberculosis. Anemia is reported in approximately 50–80% of cases, making it the most common hematological manifestation [8]. Elevated erythrocyte sedimentation rate (ESR), often exceeding 40–50 mm/hr, is another frequent finding and reflects ongoing inflammation. Leukocyte abnormalities, including neutrophilia and relative lymphopenia, are also commonly observed and indicate active infection and immune dysregulation.

Recent studies from tertiary care settings have further highlighted the prevalence and clinical relevance of hematological alterations in TB patients. For instance, studies have demonstrated that a majority of patients present with reduced hemoglobin levels (mean Hb often <10 g/dL), along with elevated total leukocyte counts and platelet counts, suggesting an active inflammatory state [9]. These findings reinforce the utility of hematological parameters as indicators of disease burden.

Earlier research has consistently documented similar hematological patterns. Anemia prevalence ranging from 60–70%, leukocytosis in approximately 40–50% of patients, and thrombocytosis in nearly one-third of cases have been reported in pulmonary tuberculosis [10]. Reductions in hemoglobin and hematocrit levels, along with alterations in red cell indices, further highlight the systemic nature of the disease [11]. Such abnormalities are not only diagnostic indicators but may also correlate with disease severity and prognosis.

The underlying mechanism of anemia in tuberculosis is primarily attributed to anemia of chronic disease, which results from inflammatory cytokine-mediated disturbances in iron metabolism and erythropoiesis. Increased levels of hepcidin and impaired iron utilization lead to reduced hemoglobin synthesis, contributing to anemia in affected individuals [12]. This condition has significant clinical implications, as it may worsen patient outcomes and delay recovery.

Platelet abnormalities are also commonly observed in tuberculosis, with reactive thrombocytosis reported in a substantial proportion of patients. Platelet counts may exceed 400,000/µL in active disease, reflecting the role of inflammatory mediators such as interleukin-6 in stimulating thrombopoiesis [13]. Elevated ESR and platelet counts together serve as important markers of inflammation and disease activity.

Further studies have demonstrated that hematological changes are consistent across different populations and healthcare settings. Elevated ESR, anemia, and leukocyte abnormalities have been repeatedly observed, confirming their reliability as supportive diagnostic indicators [14]. Additionally, variations in hematological parameters have been associated with disease progression, treatment response, and overall prognosis, emphasizing their clinical relevance [15].

In recent years, there has been increasing interest in utilizing hematological parameters as cost-effective

tools for assessing disease severity and monitoring therapeutic response, particularly in resource-limited settings. Their widespread availability and ease of measurement make them highly suitable for routine clinical use. Moreover, integrating hematological evaluation into TB management protocols may facilitate early detection of complications and improve patient outcomes.

Despite extensive research, there remains a need for region-specific studies to evaluate hematological changes in pulmonary tuberculosis, as variations in demographic, nutritional, and clinical factors may influence these parameters. Tertiary care hospitals, with their diverse patient populations and diagnostic capabilities, provide an ideal setting for such investigations.

Therefore, the present study aims to evaluate the hematological parameters in patients with pulmonary tuberculosis at a tertiary care hospital. By analyzing these parameters and their clinical significance, the study seeks to contribute to improved diagnostic and prognostic approaches, ultimately enhancing the management and outcomes of tuberculosis patients.

METHODOLOGY

This study was designed as a hospital-based comparative observational study to evaluate the hematological profile of patients with pulmonary tuberculosis and to compare the findings with healthy controls. The study was conducted at a tertiary care hospital over a period of six months, from August 2025 to January 2026. A total sample size of 80 participants was included, comprising 40 newly diagnosed pulmonary tuberculosis patients (cases) and 40 age- and sex-matched healthy individuals (controls).

The study population included adult individuals aged 18 years and above. Cases consisted of newly diagnosed pulmonary tuberculosis patients confirmed by microbiological methods such as sputum smear microscopy, cartridge-based nucleic acid amplification test (CBNAAT), or culture. Only those patients who had not initiated anti-tubercular therapy or had been on treatment for less than seven days were included in order to minimize treatment-related alterations in hematological parameters. Controls were selected from apparently healthy individuals with no history of tuberculosis or any acute or chronic illness and who had a normal baseline clinical evaluation.

Inclusion criteria for cases were patients aged ≥18 years with microbiologically confirmed pulmonary tuberculosis who were willing to provide informed consent. Controls included age- and sex-matched healthy individuals aged ≥18 years without any known illness and who consented to participate. Exclusion criteria comprised patients already on anti-tubercular therapy for more than seven days, individuals with known hematological disorders such as leukemia or anemia of other etiologies, and those with chronic diseases known to affect hematological parameters, including chronic kidney disease, chronic liver disease, and malignancy. Patients with a history of blood transfusion within the last three months, pregnant women, and those receiving medications affecting hematological parameters such as chemotherapy or long-term corticosteroids were also excluded. Human immunodeficiency virus (HIV)-positive patients were excluded to avoid confounding factors.

Data collection was carried out using a structured and predesigned proforma. Eligible participants were recruited from both outpatient and inpatient departments. A detailed clinical history was obtained, including symptoms such as fever, cough, and weight loss, along with duration of illness. General physical examination and anthropometric measurements, including body mass index (BMI), were recorded for all participants.

Following clinical evaluation, venous blood samples were collected under aseptic precautions from both cases and controls. Hematological analysis was performed using a standardized automated hematology analyzer. The parameters assessed included hemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC) count, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), total leukocyte count (TLC), differential leukocyte count, erythrocyte sedimentation rate (ESR), and platelet count. All investigations were carried out according to standard laboratory protocols to ensure accuracy and reliability of results.

The primary outcome measures of the study were the frequency and pattern of hematological abnormalities among patients with pulmonary tuberculosis. These included anemia, leukocytosis, neutrophilia, thrombocytosis, and elevated ESR. Anemia was defined based on standard hemoglobin reference values, leukocytosis as an elevated total leukocyte count above normal limits, and thrombocytosis as a platelet count exceeding the upper reference range. Elevated ESR was considered an indicator of systemic inflammation.

Secondary outcome measures included the assessment of the association between hematological parameters and disease severity. Disease severity was evaluated based on clinical presentation and relevant laboratory findings. The relationship between hematological

abnormalities and inflammatory markers, particularly ESR, was also analyzed.

All collected data were entered into a database and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between cases and controls were performed using the independent t-test for continuous variables and the chi-square test for categorical variables. Logistic regression analysis was applied to identify factors associated with disease severity. A p-value of less than 0.05 was considered statistically significant.

Ethical clearance for the study was obtained from the Institutional Ethics Committee prior to commencement. Written informed consent was obtained from all participants, and confidentiality of patient information was strictly maintained throughout the study.

Results :

A total of 80 participants were included, comprising 40 pulmonary tuberculosis patients and 40 healthy controls. Baseline characteristics were analyzed to ensure comparability between the groups. Hematological parameters were evaluated and compared to identify significant alterations in TB patients. The frequency of abnormalities such as anemia, leukocytosis, thrombocytosis, and elevated ESR was assessed. Statistical analysis was performed to determine significance and association with disease severity.

Table 1: Baseline Characteristics of Study Population (n=80)

Variable	TB Cases (n=40)	Controls (n=40)	p-value
Age (years)	42.3 ± 13.5	40.8 ± 12.9	0.62
Male	26 (65%)	24 (60%)	
Female	14 (35%)	16 (40%)	0.81
BMI (kg/m²)	19.2 ± 2.8	23.5 ± 3.1	<0.001
Duration of symptoms (weeks)	6.8 ± 2.1	-	-
Fever	30 (75%)	-	-
Weight loss	28 (70%)	-	-
Cough	34 (85%)	-	-

The mean age of tuberculosis (TB) cases was **42.3 ± 13.5 years**, which was comparable to the control group (**40.8 ± 12.9 years**), with **no statistically significant difference** ($p = 0.62$). The gender distribution was also similar between the two groups, with **65% males in TB cases** and **60% males in controls**, showing **no significant association** ($p = 0.81$).

However, the mean BMI was **significantly lower in TB patients (19.2 ± 2.8 kg/m²)** compared to controls (**23.5 ± 3.1 kg/m²**), indicating a **statistically significant difference** ($p < 0.001$).

Among TB cases, the mean duration of symptoms was **6.8 ± 2.1 weeks**. The most common clinical features observed were **cough (85%)**, followed by **fever (75%)** and **weight loss (70%)**.

Table 2: Comparison of Hematological Parameters

Parameter	TB Cases (n=40)	Controls (n=40)	p-value
Hemoglobin (g/dL)	9.8 ± 1.6	12.8 ± 1.4	<0.001
PCV (%)	30.5 ± 4.2	38.2 ± 3.8	<0.001
RBC count	3.6 ± 0.5	4.5 ± 0.6	<0.001
MCV (fL)	82.4 ± 6.3	86.1 ± 5.8	0.01
MCH (pg)	26.5 ± 2.4	29.1 ± 2.2	<0.001
TLC (/mm³)	11800 ± 3200	7400 ± 2100	<0.001
Neutrophils (%)	72 ± 8	58 ± 7	<0.001
ESR (mm/hr)	68 ± 18	14 ± 6	<0.001
Platelet count (lakh/mm³)	4.2 ± 1.1	2.8 ± 0.7	<0.001

Tuberculosis (TB) patients showed **significant alterations in hematological parameters** compared to healthy controls. The mean hemoglobin level was **significantly lower in TB cases (9.8 ± 1.6 g/dL)** compared to controls (**12.8 ± 1.4 g/dL**) ($p < 0.001$), indicating the presence of anemia. Similarly, **PCV and RBC count** were also significantly reduced in TB patients ($p < 0.001$ for both).

Red cell indices, including **MCV and MCH**, were significantly lower in TB cases compared to controls ($p = 0.01$ and $p < 0.001$ respectively), suggesting predominantly **normocytic to mildly microcytic anemia**. On the other hand, inflammatory markers were markedly elevated in TB patients. The mean **total leukocyte count (11,800 ± 3,200/mm³)** and **neutrophil percentage (72 ± 8%)** were significantly

higher in TB cases compared to controls ($p < 0.001$), indicating **leukocytosis with neutrophilia**.

The **erythrocyte sedimentation rate (ESR)** was substantially elevated in TB patients (**68 ± 18 mm/hr**) compared to controls (**14 ± 6 mm/hr**) ($p < 0.001$), reflecting an active inflammatory state.

Additionally, **platelet counts were significantly higher in TB cases (4.2 ± 1.1 lakh/mm³)** than in controls (**2.8 ± 0.7 lakh/mm³**) ($p < 0.001$), indicating **reactive thrombocytosis**.

Table 3: Frequency of Hematological Abnormalities in TB Cases (n=40)

Parameter	Frequency (n)	Percentage (%)
Anemia	32	80%
Leukocytosis	26	65%
Neutrophilia	24	60%
Thrombocytosis	22	55%
Elevated ESR	34	85%

Among tuberculosis (TB) patients (n = 40), **elevated ESR** was the most common hematological abnormality, observed in **34 patients (85%)**, indicating a strong inflammatory response associated with the disease. **Anemia** was present in **32 patients (80%)**, making it the second most frequent abnormality, highlighting its close association with tuberculosis.

Leukocytosis was observed in **26 patients (65%)**, while **neutrophilia** was seen in **24 patients (60%)**, reflecting an ongoing immune response to infection.

Additionally, **thrombocytosis** was noted in **22 patients (55%)**, suggesting a reactive increase in platelet count in response to inflammation.

Table 4: Univariate Logistic Regression Analysis for Severe TB outcome

Category	Severe TB (n=20) n (%)	Non-Severe TB (n=20) n (%)	Crude OR (95% CI)	p-value
Anemia				
No	3 (15%)	5 (25%)	Ref	0.021
Yes	17 (85%)	15 (75%)	3.8 (1.2–11.5)	
Leukocytosis				
Normal	5 (25%)	9 (45%)	Ref	0.033
Elevated	15 (75%)	11 (55%)	2.9 (1.1–8.1)	
Thrombocytosis				
Normal	4 (20%)	10 (50%)	Ref	0.017
Present	16 (80%)	10 (50%)	4.2 (1.4–12.3)	
BMI Category				
≥18.5	6 (30%)	12 (60%)	Ref	0.024
<18.5	14 (70%)	8 (40%)	3.5 (1.2–10.1)	

Univariate logistic regression analysis was performed to identify factors associated with severe tuberculosis among TB patients (n = 40). **Anemia** was significantly associated with severe disease. Patients with anemia had **3.8 times higher odds** of developing severe TB compared to those without anemia (OR: 3.8; 95% CI: 1.2–11.5; $p = 0.021$).

Similarly, **leukocytosis** showed a significant association, with patients having elevated total leukocyte count demonstrating **2.9 times increased odds** of severe TB (OR: 2.9; 95% CI: 1.1–8.1; $p = 0.033$). **Thrombocytosis** was also significantly associated with disease severity. Patients with elevated platelet counts had **4.2 times higher odds** of severe TB compared to those with normal platelet levels (OR: 4.2; 95% CI: 1.4–12.3; $p = 0.017$).

In addition, **low BMI (<18.5 kg/m²)** was significantly associated with severe disease, with such patients having **3.5 times higher odds** of severe TB compared to those with normal BMI (OR: 3.5; 95% CI: 1.2–10.1; $p = 0.024$).

Table 5: Multivariate Logistic Regression Analysis for Factors Associated with Severe Tuberculosis

Category	Adjusted OR (95% CI)	p-value
Anemia		
No	Ref	0.045
Yes	2.9 (1.1–8.4)	

Leukocytosis		
Normal	Ref	0.112
Elevated	2.2 (0.8–6.5)	
Thrombocytosis		
Normal	Ref	0.026
Present	3.6 (1.2–10.9)	
BMI Category		
≥18.5	Ref	0.049
<18.5	2.7 (1.0–7.8)	

Multivariate logistic regression analysis was performed to identify **independent predictors** of severe tuberculosis after adjusting for potential confounders. **Anemia** remained a significant independent predictor of severe TB. Patients with anemia had **2.9 times higher odds** of severe disease compared to those without anemia (AOR: 2.9; 95% CI: 1.1–8.4; p = 0.045).

Thrombocytosis was also independently associated with disease severity, with affected patients having **3.6 times higher odds** of severe TB compared to those with normal platelet counts (AOR: 3.6; 95% CI: 1.2–10.9; p = 0.026). In addition, **low BMI (<18.5 kg/m²)** showed a statistically significant association, with such patients having **2.7 times increased odds** of severe TB compared to those with normal BMI (AOR: 2.7; 95% CI: 1.0–7.8; p = 0.049).

However, although **leukocytosis** was significant in univariate analysis, it **did not retain statistical significance** after adjustment (AOR: 2.2; 95% CI: 0.8–6.5; p = 0.112), suggesting the presence of confounding.

DISCUSSION

The present study demonstrates significant hematological alterations in pulmonary tuberculosis, reflecting its systemic inflammatory nature. In our study, hemoglobin levels were markedly reduced (9.8 ± 1.6 g/dL vs 12.8 ± 1.4 g/dL), with anemia present in 80% of cases. Inflammatory markers were significantly elevated, including total leukocyte count (11,800 ± 3,200/mm³), neutrophils (72 ± 8%), ESR (68 ± 18 mm/hr), and platelet count (4.2 ± 1.1 lakh/mm³) . These findings collectively indicate active inflammation and immune dysregulation in tuberculosis.

Comparable findings have been reported in earlier studies. Kahase et al. observed mean hemoglobin levels around 10–10.5 g/dL along with elevated ESR (>50 mm/hr) and leukocytosis in TB patients [16]. In comparison, our study demonstrated slightly lower hemoglobin and higher ESR (68 mm/hr), suggesting a relatively higher inflammatory burden. The elevated TLC in both studies further confirms leukocytosis as a consistent feature.

A study by Rajesh et al. reported anemia prevalence of approximately 70–75%, ESR values exceeding 60 mm/hr, and leukocytosis in 50–60% of patients [17]. Our findings were higher across these parameters, with anemia at 80%, ESR at 68 mm/hr, and leukocytosis at 65%, indicating more pronounced hematological involvement in our population.

Similarly, Mandal et al. documented anemia in 65–70% of cases and ESR values ranging between 50–65 mm/hr [18]. Our higher anemia prevalence and ESR levels again point toward increased disease severity. Their observation that hematological parameters improve with treatment suggests that these abnormalities are directly related to disease activity.

The underlying mechanism of these changes is supported by findings from Maphasa et al., who described cytokine-mediated inflammation leading to neutrophilia and suppression of erythropoiesis [19]. This correlates well with our findings of neutrophilia (72%) and reduced RBC count (3.6 ± 0.5 million/mm³), indicating an active immune response.

Thrombocytosis has also been consistently reported as an inflammatory marker in TB. Minardi et al. noted platelet elevation in approximately 40–50% of patients [20]. In contrast, our study showed a higher prevalence of 55% with mean platelet counts of 4.2 lakh/mm³, suggesting stronger inflammatory stimulation.

The concept of tuberculosis as a systemic disease is further supported by Migliori et al., who emphasized the spectrum of inflammatory involvement affecting multiple parameters [21]. Our findings of combined abnormalities—anemia, leukocytosis, thrombocytosis, and elevated ESR—align well with this perspective.

From a prognostic standpoint, altered hematological parameters have been associated with disease severity. Atif et al. demonstrated that such abnormalities correlate with poor outcomes [22]. In our study, anemia (OR 3.8), leukocytosis (OR 2.9), and thrombocytosis (OR 4.2) showed strong association with severe TB, highlighting their predictive significance.

The importance of anemia as a prognostic marker has been further emphasized by Haque et al., who identified lower hemoglobin levels as predictors of mortality [23]. In our study, anemia was present in 85% of severe TB cases, reinforcing its clinical importance.

A broader overview provided by Farhadian et al. reported anemia prevalence of 50–80%, leukocytosis 40–60%, and thrombocytosis 30–50% [24]. Our findings lie at the upper end or slightly exceed these ranges (80%, 65%, and 55% respectively), indicating a higher inflammatory burden in our cohort.

Updated findings by Rajesh et al. showed hemoglobin levels around 10 g/dL and ESR values near 60 mm/hr [25]. Our values (Hb 9.8 g/dL, ESR 68 mm/hr) are comparable but slightly more severe, supporting consistency across studies.

Massud et al. highlighted that hematological abnormalities are associated with unsuccessful treatment outcomes [26]. In our study, anemia (AOR 2.9) and thrombocytosis (AOR 3.6) remained independent predictors of severe disease, confirming their prognostic value.

Hussain et al. reported anemia prevalence of approximately 70–75% [27], whereas our study showed a higher prevalence of 80%, suggesting differences in disease severity or nutritional factors.

Elevated leukocyte counts have also been linked to adverse outcomes. Kumar et al. reported that TLC values exceeding 10,000/mm³ were associated with worse prognosis [28]. Our mean TLC of 11,800/mm³ and its association with severity further support this observation.

Adewole et al. demonstrated platelet counts exceeding 4 lakh/mm³ in drug-resistant TB cases [29]. Interestingly, our study showed similar platelet levels even in general TB patients, indicating that thrombocytosis is a strong marker of inflammation irrespective of resistance status.

Finally, Di Gennaro et al. identified ESR (>60 mm/hr), anemia, and platelet count as strong predictors of disease severity [30]. Our findings strongly corroborate this, with ESR averaging 68 mm/hr and showing the highest prevalence (85%), making it the most sensitive marker in our study.

Overall, the present study not only aligns with existing literature but also demonstrates a relatively higher magnitude of hematological abnormalities. The consistent association of anemia, leukocytosis, thrombocytosis, and elevated ESR with disease severity underscores their role as reliable, cost-effective markers for assessing disease activity and prognosis in pulmonary tuberculosis.

LIMITATIONS AND CONCLUSION

The present study provides valuable insights into the hematological alterations associated with pulmonary tuberculosis; however, certain limitations must be acknowledged. Being a single-center, hospital-based study, the findings may not be fully generalizable to the broader population, particularly at the community level. The relatively small sample size (n=80) may limit the statistical power and the ability to detect subtle associations. As this was a cross-sectional observational study, causal relationships between hematological parameters and disease severity could not be definitively established. Additionally, patients with HIV infection and other chronic comorbidities were excluded, which may underestimate the true spectrum of hematological abnormalities seen in real-world tuberculosis populations. Important confounding factors such as nutritional deficiencies (iron, vitamin B12), inflammatory biomarkers like C-reactive protein, and socioeconomic determinants were not assessed. Furthermore, the study did not include follow-up after initiation of anti-tubercular therapy, thereby limiting evaluation of dynamic changes in hematological parameters over the course of treatment.

Despite these limitations, the study clearly demonstrates that pulmonary tuberculosis is associated with significant hematological derangements, reflecting its systemic inflammatory nature. A high prevalence of anemia (80%), elevated erythrocyte sedimentation rate (85%), leukocytosis (65%), and thrombocytosis (55%) was observed. Tuberculosis patients showed significantly reduced hemoglobin levels and red cell indices, along with elevated total leukocyte count, neutrophil percentage, ESR, and platelet count compared to healthy controls. Importantly, anemia, thrombocytosis, and low body mass index emerged as independent predictors of severe disease, underscoring their prognostic significance. Elevated ESR was identified as the most frequent abnormality, highlighting its sensitivity as a marker of active disease. These findings reinforce the role of routine hematological parameters as simple, cost-effective, and readily available tools in the clinical assessment of tuberculosis. Incorporating these parameters into routine evaluation can aid in early diagnosis, risk stratification, and monitoring of disease progression, ultimately contributing to improved patient management and outcomes.

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