Trends in Clinical and Medical Sciences

PSR Press

Article

Assessment of hematological parameters in patients of active pulmonary tuberculosis

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Received: 10 March 2023; Accepted: 13 May 2023; Published: 14 May 2023.

Abstract: Tuberculosis is a major public health issue in India, caused by Mycobacterium tuberculosis, and it affects not only the lungs but also other organs and bone marrow. Hematological abnormalities are frequently observed in tuberculosis patients and can serve as markers for diagnosis, prognosis, and treatment response. The aim of this study was to evaluate various hematological characteristics in patients with pulmonary tuberculosis. A total of 50 diagnosed tuberculosis patients were included, and their blood samples were collected at MGM Medical College and associated hospitals. Hematological analysis was performed using 4 ml of venous blood in an ethylenediamine tetra acetic acid (EDTA) tube. Two milliliters of blood were used for hematological analysis with a hematology analyzer, and the remaining 2 ml were utilized for erythrocyte sedimentation rate (ESR) measurement using Wintrobe's method. The observations revealed significantly low levels of hemoglobin, packed cell volume (PCV), and blood indices values, indicating anemia. The white blood cell (WBC) count, absolute neutrophil count, platelet count, and ESR values were elevated in tuberculosis patients. In conclusion, measuring hematological parameters in tuberculosis patients provides a simple and cost-effective approach to monitor disease progression and complications, particularly in resource-limited settings like India.

Keywords: Tuberculosis; Hematological abnormalities; Pulmonary tuberculosis; Diagnosis; Prognosis.

1. Introduction

Tuberculosis (TB) remains a major global health problem. It is one of the top ten causes of death worldwide and the leading cause of death from a single infectious agent [1].Tuberculosis is a major public health problem in India [2]. It is the most common infectious disease caused by mycobacterium tuberculosis. Pathogenesis of the disease is based on cell-mediated immune response [3]. About 40% of the Indian population is infected with TB bacilli. Patients with cavitary lesions are the major source of infection. Most of patients are usually sputum smear-positive. Coughing produces small droplets which are infective and approximately 3000 droplet nuclei remain in the air for a prolonged period of time [4]. There is an important role of T-cells in immunity to mycobacteria [5]. To prevent and control this infection, early diagnosis and treatment should be done, and monitoring TB patients during treatment is important for better outcomes [6]. Tuberculosis not only affects lungs but also the bone marrow and causes significant hematological abnormalities such as anemia, leukocytosis neutrophilia, lymphopenia, thrombocytopenia and also elevated ESR in the patients.

Hematological parameters like hemoglobin, Packed Cell Volume (PCV), red blood cell (RBC) count, blood indices, platelet count, white blood cell (WBC) count, erythrocyte sedimentation rate (ESR) can be used for diagnosis, prognosis, and follow-up of patients [7]. There are few studies done that show that ESR can serve as sensitive markers for tuberculosis [8].

This study was carried out to explore the haematological profile of TB patients which will help in identification of hematological risk factors and help in minimizing the risk of transmission among vulnerable groups.

2. Material and methods

This was a prospective study carried out in the department of pathology at M.Y. Hospital for a duration of 3 months from September 2022 to December 2022. 50 EDTA blood samples of tuberculosis patients received in the department of pathology were selected. Simple random method was used. All the data was recorded in case record form. About 4 ml of venous blood was collected with proper aseptic precaution. 2 ml EDTA tube blood was used for hematological analysis by using hematology analyzer. Rest 2 ml blood was used for measurement of ESR by the Wintrobe method. Hematological parameters, including hemoglobin (Hb), total leukocyte count (TLC), differential leukocyte count (DLC), hematocrit (HCT), platelet counts, blood indices like mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

All sputum smears positive TB patients (Age beyond 18 years) diagnosed with pulmonary TB were included in study. All Pregnant women, pediatric patients, patients with extrapulmonary TB and old TB with multi drug resistance (MDR), chronic renal or liver disease, leukemia, HIV patients were excluded from study.

3. Observation and Results

A total of 50 diagnosed tuberculosis cases were included in the present study.36 patients were males and 14 were female. Maximum cases were observed in the age group of 40-50 years, maximum patients were anemic with 36 cases with microcytic anemia. WBC count was raised in 34 cases with neutrophilia in 36 cases. Thrombocytosis was observed in 32 cases and ESR was raised in 46 tb patients. Other parameters like MCV, MCH, MCHC,PCV and RBC count were lower than the normal limit. Age wise distribution of cases is given in Table 1, while sex wise distribution of cases in given in Table 2. The Hemoglobin levels and severity of anemia among cases is presented in Table 3.

Table 1. Age wise distribution of cases

Age group	No. of cases	Percentage (%)
20-30 yrs	4	8%
31-40 yrs	10	20%
41-50 yrs	22	44%
51-60 yrs	8	16%
>60 yrs	6	12%
Total	50	100%

Table 2. Sex wise distribution of cases

Sex	No of cases	Percentage
Female	14	28%
Male	36	72%
Total	50	100%

Table 3. Hemoglobin levels and severity of anemia among cases

Hemoglobin/Severity of anemia	No of cases	Percentage
10-12 gm/dl(mild anemia)	20	40%
7-9.9gm/dl(moderate)	24	48%
<7 gm/dl(severe)	6	12%

Table 4. Type of anemia among cases

Type of anemia	No of cases	Percentage
Microcytic hypochromic	36	72%
Normocytic normochromic	10	20%
Macrocytic hypochromic	4	8%

Table 5. WBC parameters in patients

Total WBC count	No of cases	Percentage
Normal count (4000-11000/cumm)	12	24%
Leukocytosis (>11000/cumm)	34	68%
Leukopenia(<4000/cumm)	4	8%
Absolute Neutrophil count		
Normal count(2000-7000/cumm)	10	20%
Neutrophila(>7000/cumm)	36	72%
Neutropenia (<2000/cumm)	4	08%.
Absolute lymphocyte count		
Normal (1000-3000/cumm)	34	68%
Lymphocytosis(>3000/cumm)	4	8%
Lymphocytopenia (<1000/cumm)	12	24%

Table 6. Platelet and ESR in TB patients

Platelet		
Normal (1.5-4.5 lacs/cumm)	13	26%
Thrombocytosis (>4.5 lacs/cumm)	32	64%
Thrombocytopenia (<1.5lacs /cumm)	5	10%
ESR		
<20 mm at the end of 1 hr	4	8%
20-40 mm at end of 1 hr	10	20%
40-60 mm at end of 1 hr	28	56%
>60 mm at end of 1 hr	8	16%

4. Discussion

Tuberculosis remains a leading health problem in developing country like India and one of the most important communicable diseases in the world. Symptoms includes cough with sputum for more than three weeks, evening rise of fever, chills, night sweats, loss of appetite, weight loss, pallor, and fatigue. The infection may spread to other organs and is known as extrapulmonary TB. Diagnosis of TB is based on detection of tubercle bacili in sputum by Ziel Nelson staing, followed by blood or sputum culture along with an X-ray of the chest. Other test includes interferon Gamma Release Assays (IGRAs), polymerase chain reaction (PCR) etc. However, in developing countries, a rapid and cost-effective diagnostic test would be valuable. Assessment of hematological parameters is one such cost-effective approach for diagnosis and prognosis of tuberculosis patients.

In present study we studied various hematological parameters of tuberculosis patients. Maximum cases were observed in males -36(72%) and 14(28%) cases were observed in females. The results were comparable with the study done by Shah et al. [4], Thatoi PK [12] and Banerjee M [13], but the findings are different from study done by Yasin A et al. [10] where cases were more among women than men. In present study maximum cases -22(44%) were found in elderly in 4th to 5th decade followed by 10 cases in 3rd to 4th decade ,08 cases in 5tg to 6th decade,06 cases in more than 60 yrs and only 04 cases in 20-30 yrs. Similar findings were observed in study done by Shah et al, Rohini K et al. [9] Yasin A et al. [10] and Rajesh H et al. [11] The lowest prevalence was reported in age group of 20-30 yrs.

Anemia is the most common hematological complication observed in tuberculosis patients, and it one of the risk factors for mortality [14]. There is icreased release of cytokines like tumor necrosis factor-± (TNF-±),

Interferon (IFN), and Interleukin-6 (IL) 6 leads to reduction of Erythropoietin formation, resulting in bone marrow depression along with altered iron metabolism leading to anemia [15]. There is absence of bone marrow iron, resulting in iron deficiency anemia. TNF and IL also increase iron uptake and ferritin synthesis. In this study, we assessed the severity of anemia by hemoglobin level. We reported 48% cases with moderate anemia having Hb between 7-9.9 gm/dl, 40% cases with mild anemia, and only 12% of the patients had severe anemia with Hb <7 gm/dl. Morphologically, a microcytic hypochromic anemia was most common found in 72% cases, with normocytic normochromic in 20% and 08% macrocytic anemia. Also, PCV, MCV, MCH, and MCHC were decreased. These findings are comparable with other studies like Bashir et al. [16] and Yasin et al. [10] and Shah et al. [4]. WBC parameters showed leukocytosis in 34 cases (68%), followed by normal count in 10 cases and 04 cases showed leucopenia. Such findings attributed that in patients of tuberculosis, WBC count increases during infection along with macrophages as a part of the body's defense mechanism. Neutrophilia was observed in 72% cases (36 cases) and 20% (10 cases) showed normal neutrophil count. Neutrophilia occurs due to immune mediated response to tubercle bacilli. Lymphocyte count was found normal in 68% cases with lymphopenia in 24% cases.

These findings were similar to previous studies mentioned above. [,0410,11,13] .But study done by Thatoi [12] reported neutropenia as a significant finding.

Thrombocytosis was found in 64% cases (32) which was comparable with the findings of Yasin et al. [10], Shah et al. [10] and Banerjee M [13]. Various cytokines like IL 6 which is involved in granuloma formation promote platelet production and can cause thrombocytosis.

Erythrocyte sedimentation rate (ESR) was found raised in tb patients. In our study, ESR was elevated in 92% of the patients. Similar findings were observed in other studies like Rohini K et al. [10] Yasin A et al. [9] and Thatoi Pk et al. [12] and Shah et al. [4]. ESR is used as a sensitive marker for inflammatory response and is helpful in monitoring disease progression and retrogression. The findings of the current study can be used as an indicator of disease progression, to decrease the rate of morbidity and mortality and also to prevent complications of the disease.

5. Conclusion

Tuberculosis remains a leading health problem in developing country like India and one of the most important communicable diseases in the world. . Diagnosis and progression of tb requires which are expensive and cannot be done routinely Assessment of hematological parameters is one such cost-effective approach for diagnosis and prognosis of tuberculosis patients Hematological parameters like hemoglobin, Packed Cell Volume (PCV), red blood cell (RBC) count, blood indices, platelet count, white blood cell (WBC) count, erythrocyte sedimentation rate (ESR) can be used for diagnosis, prognosis, and follow-up of patients.

Author Contributions: All authors contributed equally to the writing of this paper. All authors read and approved the final manuscript.

Conflicts of Interest: The authors declare that they do not have any conflict of interests.

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