Study of Anemia among Newly Diagnosed Pulmonary Tuberculosis Patients at a Tertiary Care Hospital

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Abstract:

Aims & Objectives: To investigate anemia in patients with newly diagnosed pulmonary tuberculosis and association between anemia patients' hemoglobin levels and the severity of their pulmonary tuberculosis.

Methods: The present hospital-based study was conducted for one year (January 2023 to December 2023) on 100 pulmonary tuberculosis patients who attended Emergency, IPD, OPD of Muzaffarnagar Medical College and Hospital. The samples were tested using an automated cell counter that measured all relevant parameters, such as hemoglobin, hematocrit, red blood cell count, MCV, MCH, and MCHC.

Results: Anemia was present in maximum study subjects (66%) and showed a statically significant value (p=0.002). Of the total 66 anemic subjects, 41 (62.12%) had normocytic normochromic anemia, 18 (27.27%) had hypochromic microcytic summary 51 anemia, 7 (10.61%) had hypochromic normocytic and no subject had macrocytic anemia, showing a statistically significant value (p=0.001). Sputum positivity for AFB grade showed a statistically significant difference between anemic and non-anemic subjects (p<0.01).

Conclusion: The study concluded that a significant proportion of TB patients had anemia. The results of the study indicate that anemia is particularly common in patients with the most severe clinical forms of tuberculosis (TB), and that it may be utilized as a biomarker of the severity of tuberculosis. Anemia was substantially correlated with grade of AFB.

Keywords: Anemia, pulmonary tuberculosis, TB, AFB.

Introduction

Pulmonary tuberculosis (TB) remains one of the most lethal infectious diseases globally, significantly impacting public health systems, especially in developing countries. The World Health Organization (WHO) estimates that approximately 10 million people fell ill with tuberculosis worldwide in 2019, with a significant proportion of these cases leading to fatal outcomes if left untreated (WHO, 2020).

The disease's persistence and spread are largely due to socio-economic factors, bacterial virulence, and the interaction with other comorbid conditions such as HIV/AIDS (Smith, 2018) [1].

Anemia is commonly observed in patients with chronic infections, including tuberculosis. The pathophysiological link between TB and anemia is multifactorial, involving chronic inflammation that suppresses erythropoiesis, malnutrition, and iron sequestration by macrophages, among other mechanisms (Johnson et al., 2017). [2] Studies have shown that anemia can adversely affect the prognosis of TB, potentially complicating treatment and extending recovery periods (Lee, 2019) [3].

Importance of Studying Anemia in Newly Diagnosed Tuberculosis Patients Investigating the prevalence and severity of anemia in newly diagnosed TB patients is crucial for several reasons.

First, it aids in the holistic management of the disease, as addressing anemia can significantly improve patient outcomes and quality of life (Gupta & Kumar, 2021) [4]. Second, understanding the prevalence of anemia in this group can help tailor more effective initial treatment strategies,

potentially reducing hospital stays and healthcare costs (Brown, 2020) [5].

Objectives of the Study

To investigate anemia in patients with newly diagnosed pulmonary tuberculosis and association between anemia patients' hemoglobin levels and the severity of their pulmonary tuberculosis.

Materials and Methods

The present hospital-based study was conducted for one year (January 2023 to December 2023) on 100 pulmonary tuberculosis patients excluding COVID time who attended Emergency, IPD, OPD of Muzaffarnagar Medical College and Hospital.

Data were collected by simple random sampling.

Inclusion Criteria:

- Patients newly diagnosed with pulmonary tuberculosis, confirmed through microbiological and radiological testing.
- Age 18 years and above.
- Willingness to participate in the study, as indicated by signed informed consent.

Exclusion Criteria:

- Patients with known chronic diseases that could independently cause anemia, such as chronic kidney disease or malignancy.
- Patients previously treated for tuberculosis.
- Pregnant women, due to the different physiological demands and anemia parameters in this group.

Study Procedure and Evaluation

Peripheral blood analysis and a complete blood cell (CBC) count were performed. 2.5 ml of blood was drawn from the patient and placed in EDTA (ethylenediaminetetraacetic acid) containers. The samples were tested using an automated cell counter that measured all relevant parameters, such as hemoglobin, hematocrit, red blood cell count, MCV, MCH, and MCHC. Five microliters of the specimen were used to create a thin blood film for examining the morphology of the blood cells

Statistical Analysis: Statistical analysis was performed using SPSS software (Version 25.0, IBM Corp.). Descriptive statistics was used to characterize the study population in terms of demographics and baseline health characteristics.

Results

Distribution of Anemia Status among PTB Patients: This bar chart shows the number of TB patients with and without anemia. It indicates how prevalent anemia is among the studied TB patients.
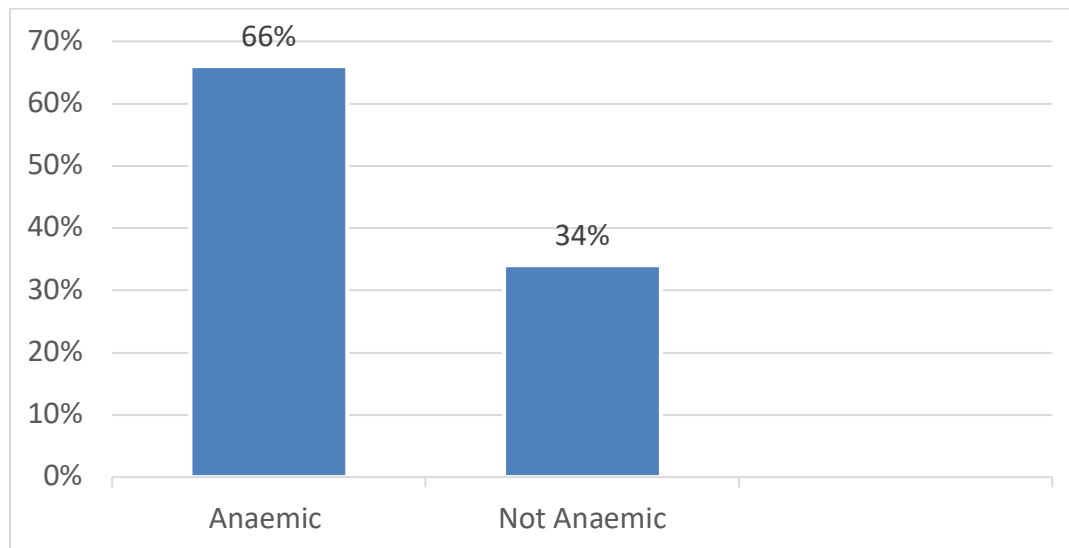

Figure 1:

Classification of anemia among the study population: Maximum subjects had mild anemia (n=30, 30%) followed by moderate anemia in 29% subjects and severe anemia was present in only 6% patients.

Table 1:

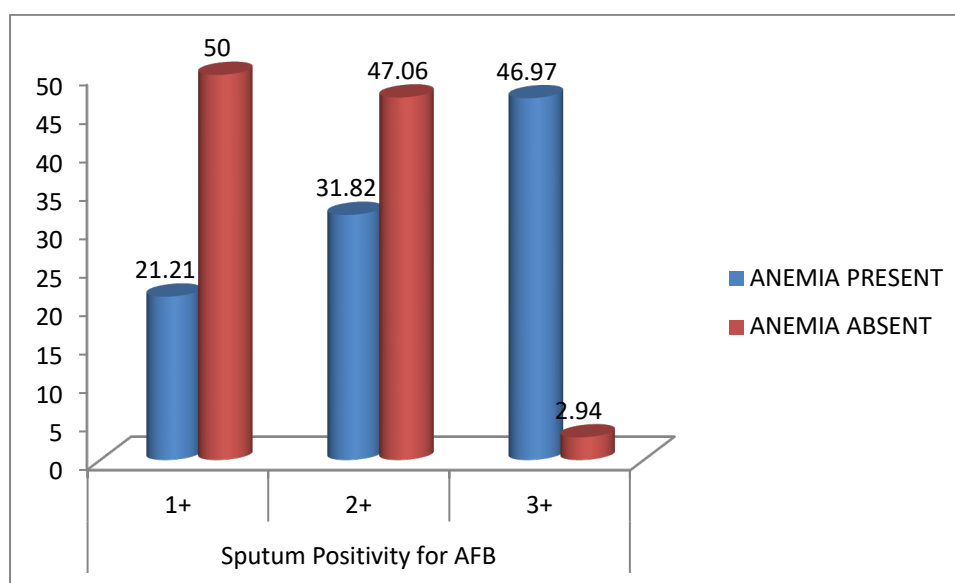| Anemia	N	%
Mild Anemia	30	30
Moderate Anemia	29	29
Severe Anemia	7	7

Distribution of sputum positivity for AFB according to anemia among study subject: Sputum positivity for AFB grade +1 was found in 14 (21.21%) anemic subjects and 17 (50%) non anemic subjects, +2 grade was found in 31.82%

anemic subjects and 47.06% non anemic subjects and +3 grade was found in 46.97% anemics and 2.94% non- anemics, showing a statistically significant difference (p<0.01).

Table 2:

Sputum Positivity for AFB	Anemia			
	Present		Absent	
	N=66	%	N=34	%
1+	14	21.21	17	50
2+	21	31.82	16	47.06
3+	31	46.97	1	2.94
p value	<0.01*			

Figure 2:

Table 3: Type of anemia among the study population

Anemia	N=66	%	p value
Normocytic Normochromic Anemia	41	62.12	0.001*
Hypochromic Microcytic Anemia	18	27.27	
Hypochromic Normocytic Anemia	7	10.61	
Macrocytic Anemia	0	0	

Of the total 66 anemic subjects, 41 (62.12%) had normocytic normochromic anemia, 18 (27.27%) had hypochromic microcytic anemia, 7 (10.61%) had hypochromic normocytic anemia and no subject had macrocytic anemia, showing a statistically significant value (p=0.001).

Discussion

Anemia was present in maximum study subjects (66%) and was absent in 34% patients of TB, showing a statically significant difference between the two (p=0.002). Similar were the findings of Baruch Baluku J et al., (2022) [6] who found that almost 60%of people with TB had anemia. In a study done by Dileepan et al. (2017) [8] anemia was found in 75.5% of the Discussion 45 study participants. De Mendonca EB et al., (2021) [7]

also found that the prevalence of anemia was 61.2%, similar to our results. Maximum subjects had mild anemia (n=30, 30%) followed by moderate anemia in 29% subjects and severe anemia was present in only 7% patients. In study done by Baruch Baluku J et al., (2022) [6] of the 210 people with anaemia, 85 (40.5%) had mild, 101 (48.1%,) had moderate and 24(11.4%) had severe anaemia. This result is in agreement with the global estimate of the prevalence of anaemia in TB of 62% [9]. Similar results were seen in study done by Dileepan et al. (2017) [8] who found that out of 151 anemic study participants, 101 (66.9%) had mild anemia, while 35(23.2%) had moderate and 15 (9.9%) had severe anemia. In study done by de Mendonca EB et al., (2021) [7] they also found that 27.5% of the subjects had mild anemia, 27.5%

moderate anemia and 6.2% severe anemia. Types of anemia of the total 66 anemic subjects, 41 (62.12%) had Normocytic Normochromic Anemia, 18 (27.27%) had Hypochromic Microcytic Anemia, 7 (10.61%) had Hypochromic Normocytic Anemia and no subject had Macrocytic Anemia, showing a statistically significant value (p=0.001). This result was in accordance to finding of de Mendonca EB et al., (2021) [7] who found that 60.8% subjects had normochromic normocytic anemia, 27.8% hypochromic microcytic anemia and 11.4% hypochromic normocytic anemia or normochromic microcytic anemia. Macrocytic anemia was not observed in any of the participants, like in present study. Similar were the findings of Dileepan et al. (2017) [8] who reported most common type of anemia was Normocytic anemia (60.3%) followed by microcytic anemia (36.4%) and macrocytic anemia (3.3%). In present study, sputum positivity for AFB grade +1 was found in 14 (21.21%) anemic subjects and 17 (50%) non anemic subjects, +2 grade was found in 31.82% anemic subjects and 47.06% non anemic subjects and +3 grade was found in 46.97% anemics and 2.94% non-anemics, showing a statistically significant difference (p<0.01). This suggest that as grade of positivity of AFB increases chance of subjects having anemia increases. These findings also suggest that anaemia is associated with the features of severe TB disease. These findings were similar to results of Baruch Baluku J et al., (2022) [6] who found very high sputum bacillary load (22.5% vs. 33.3%, P = 0.020) among anemic subjects.

Conclusion

In conclusion, a significant proportion of TB patients had anemia. Although hypochromic microcytic anemia was also frequently observed, normocytic normochromic anemia predominated. Common forms of anemia were mild and moderate. The results of the study indicate that anemia is particularly common in patients with the most severe clinical forms of tuberculosis (TB), and that it may be utilized as a biomarker of the severity of tuberculosis. Anemia was substantially correlated with grade of AFB. Complete blood count is an easy-to-use test that is widely accessible, making it a valuable tool for diagnosing severe tuberculosis cases in clinical settings.

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