Anemia in Pulmonary Tuberculosis and Treatment Outcome

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ABSTRACT

Introduction: Tuberculosis (TB) remains a major health problem in southeast Asia, especially in India. Persons with pulmonary tuberculosis (PTB) are commonly anemic, especially in poor low-socioeconomic population. Here, we assessed the TB treatment outcome in anemic and nonanemic TB patients.

Materials and methods: A total of 302 patients more than 18 years old with confirmed PTB were included from Government Medical College-associated hospital, Datia, Madhya Pradesh, in 2023. Anemia severity (mild, moderate, and severe) based on hemoglobin (Hb) estimation. Anemia associated with unfavorable outcome (death, failure, lost to follow-up, regimen modification, or relapse), compared with treatment success (cure or treatment completion).

Results: Out of 302 participants, 210 (69.53%) were anemic at baseline. Patients with moderate/severe anemia were more symptomatic and had higher frequencies of unfavorable outcomes compared with the other groups. Severe anemia was associated with unfavorable outcomes like death.

Conclusion: Pulmonary TB patient with moderate to severe anemia has significant impact on antitubercular treatment (ATT) outcome and significant risk factor for death.

Keywords: Antitubercular treatment, Hemoglobin, Lost to follow-up, Pulmonary tuberculosis, Tuberculosis.

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INTRODUCTION

Tuberculosis (TB) is still a global health challenge, and about 1.6 million deaths per year is associated with TB. About 10.6 million TB cases were reported worldwide in 2021.[1] Tuberculosis treatment with antitubercular treatment (ATT) is associated with disease progression and poor anti-TB treatment outcomes, such as human immunodeficiency virus (HIV) coinfection, consumption habits, diabetes mellitus, and anemia.[2–4]

Anemia is defined as low hemoglobin (Hb) value: below 13 gm/dL in men and below 12 gm/dL in women. It is often liked with inflammatory or infectious conditions.[5] This condition is commonly identified in pulmonary tuberculosis (PTB)—noted in 61.5% of TB cases in a recent meta-analysis—and is frequently described as a marker of greater disease severity and more advanced disease.[6] Anemia in PTB is multifactorial and is often attributed to inflammation, malnutrition, chronic disease, and direct bone marrow suppression by TB infection.[7] Anemia is a major public health problem regardless of TB. It commonly affects population of low- and middle-income countries due to nutritional deficiency and coinfection.

The risk of developing TB is more in anemic patients. It is 3.6 times greater than in nonanemic patients; such risk appears to increase as per severity of anemia.[8] Anemia is associated with severe clinical forms of TB, such as meningeal and disseminated TB.[9] The association between anemia and ATT outcome can provide more focused and optimized treatment of TB.

Previous study demonstrated that TB and HIV coinfection dysregulate the immune activation.[10,11] Anemia prior to infection is associated with treatment outcome.

This study focused on identification of anemia in confirmed TB cases, and closely monitored severe anemic patients to establish the correlation of PTB and its treatment outcome.

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MATERIALS AND METHODS

After taking all ethical clarification, 302 PTB-positive cases were taken from associated hospital of Government Medical College, Datia, Madhya Pradesh, for 1-year period.

Inclusion criteria included age 18 years and above, sputum acid-fast bacillus test-positive, and new or recurrent drug-sensitive TB cases. This study excludes age less than 18 years, extrapulmonary TB, and drug-resistance TB cases. Demographic data were studied, and Hb estimation with categorization of anemia on the basis of Hb label (nonanemic, mild, moderate, and severe) was carried out. Treatment outcome in the form of favorable (cure and treatment completed) and unfavorable [treatment failure, lost to follow-up (LTFU), recurrence, or death during treatment] outcomes were studied. Anemic and nonanemic PTB patients were having different treatment outcomes.

RESULTS

All patients as per inclusion criteria were taken for study. Totally 302 PTB-positive patients were taken for this study. Sex ratio was male 189 (62.58%) and female 113 (37.41%). On the basis of Hb estimation,

Table 1: Demography of anemic and nonanemic PTB patients

Parameter		Group (total PTB patients, N = 302)	Anemic 210 (69.53%)	Nonanemic 92 (30.46%)
Age	18–30 years	43 (20.47%)	20 (21.73%)	
	31–50 years	78 (37.14%)	26 (28.26%)	
	>50 years	89 (42.38%)	46 (50%)	
Gender				
Male		189 (62.58%)	137 (65.23%)	63 (68.47%)
Female		113 (37.41%)	73 (34.76%)	29 (31.52%)
Socioeconomic status	Middle	62 (29.52%)	43 (39.56%)	
	Lower	148 (70.47%)	47 (43.24%)	

Table 2: Anemia severity in PTB patient

Anemic and nonanemic	Number of PTB (%)
Nonanemic [Hb >13 gm/dL (male) and >12 gm/dL (female)]	92 (30.46)
Mild	147 (70.00)
Moderate	49 (23.33)
Severe	14 (6.66)

Table 3: Anemia severity and PTB treatment outcome

Anemia severity	Favorable treatment outcome n = 241 (79.80%)	Unfavorable treatment outcome n = 61 (20.19%)
Mild	133 (55.18%)	14 (22.95%)
Moderate	34 (14.10 %)	15 (24.59%)
Severe	05 (2.07%)	09 (14.75%)
Nonanemic	72 (29.87%)	20 (32.78%)

210 (69.53%) were anemic and 92 (30.46%) were nonanemic at baseline. Lower and middle socioeconomic PTB patients were more prone for anemia. Results are summarized in Table 1.

All anemic patients were divided into mild (for males Hb above 10–13 gm/dL and for females Hb above 10–12 gm/dL), moderate (Hb below 10 to above 8 gm/dL for males), or severe (Hb below 8 gm/dL). These results are summarized in Table 2.

A favorable treatment outcome was defined as cure or completed treatment. An unfavorable treatment outcome was defined as treatment failure, LTFU, recurrence, or death during treatment. The definitions for clinical and bacteriological cure, failure, LTFU, recurrence, and death corresponded with the recently updated World Health Organization guidelines.[12]

During the follow-up period, 241 (79.80%) patients had a favorable outcome (cure: 138 and treatment completed: 103), whereas 61 (20.19%) experienced an unfavorable outcome (death: 2; failure: 15; LTFU: 36; and recurrence: 8).

Results of treatment outcome are depicted in Table 3.

DISCUSSION

This study described anemia in PTB patient. In our study, anemia was more common in male (74.5%) patients with PTB as compared with the females (25.4%). Similar results were reported by a study conducted by Oliveira et al.[13] Antitubercular treatment outcome varied favorable (79.80%) and unfavorable (20.19%) in nonanemic and anemic TB patients, respectively. In this study,

favorable treatment outcome varied in various types of anemia: Mild (55.18%), moderate (14.10%), and severe anemic (2.07%). Unfavorable treatment outcome is seen in TB patient with mild anemia (22.95%), moderate anemia (24.59%), and severe anemia (14.75%).

In our study, maximum number of patients (55.18%) had mild anemia. A similar result was observed by Lee et al.[14]

In the current study, anemia was more common in patients belonging to lower socioeconomic background.

This study limits the other test for anemia assessment because only Hb estimation was done for severity of anemia. No other test was applied for severity assessment of anemia. Another limitation of this study is that the cause of anemia in TB patient could not be find out.

CONCLUSION

With the above limitations noted, our study established that moderate to severe anemia pre-ATT directly predicted the risk of death in PTB. This simple Hb estimation could lead to early interventions that might decrease the risk of poor treatment outcomes, including in limited-resource settings. Thus, PTB patient with moderate to severe anemia has significant impact on ATT treatment outcome.

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