RESEARCH ARTICLE

PREVALENCE AND THE PROGRESS OF ANEMIA ASSOCIATED WITH NEWLY DIAGNOSED PULMONARY TUBERCULOSIS PATIENTS: A COHORT STUDY

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ARTICLE INFO	ABSTRACT
	Background: Pulmonary Tuberculosis (TB) is commonly associated with reversible peripheral blood abnormalities. Anemia is associated with more severe forms of TB and poorer TB outcomes, including deaths. **Objectives:** To determine the hematological profile among newly diagnosed tuberculosis patients. **Methods:** The prospective study was conducted among 200 newly diagnosed pulmonary TB patients at DOTS centre, Najafgarh, New Delhi between 2015-16.Blood sample was collected to measure Hemoglobin at the start and the end of Intensive Phase(IP) of anti-tuberculosis treatment. Data was entered and analysed in MS-Excel. **Results:** Anemia was found in 151 (75.5%) and 99 (49.5%) of the study participants at the start and the endof Intensive phase respectively. Most common type of anemia was Normocytic anemia. **Conclusions:** It is recommended that the universal screening for anemia at the time of diagnosis of tuberculosis should be done to improve the treatment outcome.

INTRODUCTION

Tuberculosis (TB) is a major global health problem and ranks as the second leading cause of death from infectious diseases, after Human Immunodeficiency Virus (HIV) infection. Pulmonary Tuberculosis accounts for more than 85% of all TBcases. In the year 2015, there were a total of 10.4 million new tuberculosis cases and 1.4 million tuberculosis deaths globally. (WHO 2017) In India, in the year 2015 there were an estimated 2.84 million new cases of tuberculosis and a total of 4.8 lakh tuberculosis deaths. (Revised National Tuberculosis Programme, TB India, 2017) Anemia is the third cause of global years lived with disability (YLD), responsible for more than 600 YLD per 100,000 people and shows regional variation in incidence and prevalence. (Vos *et al*., 2012; McLean *et al*., 2009) An estimated 1.6 billion people, or nearly one-quarter of the world's population, are anemic, a condition characterized by a lower than normal hemoglobin concentration in the blood. (Worldwide prevalence of anaemia 1993–2005, 2008) Pulmonary tuberculosis is commonly associated with reversible peripheral blood abnormalities. The prevalence of anemia

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among TB patients ranges between 30–94%. (Lee *et al*., 2006; Isanaka *et al*., 2012; Saathoff *et al*., 2011; Hussain *et al*., 2004; Olaniyi and Aken'Ova, 2003) It has been shown that anemia is more likely to occur among TB patients compared to healthy controls. (Karyadi *et al*., 2000) More importantly, anemia is associated with more severe forms of TB[12] and poorer TB outcomes, including deaths. (Isanaka *et al*., 2012; Hussain *et al*., 2004; Kourbatova *et al*., 2006) In India, both tuberculosis and anemia are public health problems. Hence, against this background, the present study has been planned to find out hematological profile among newly diagnosed tuberculosis patients.

MATERIALS AND METHODS

The Cohort study was conducted at Directly Observed Treatment Shortcourse (DOTS) centre, of Rural Health Training Centre (RHTC), Najafgarh, New Delhi between December 2014 and May 2016. It has a Designated Microscopiy Centre (DMC) for TB, which functions under the chest clinic Rao Tula Ram Memorial Hospital, Jaffarpur, New Delhi. (The Tuberculosis Association of India, 2017) A total of200 newly diagnosed smear positive category I pulmonary TB patients aged more than 15 years enrolled between

February 2015 and January 2016 were included and previously diagnosed category I, category II and category IV pulmonary TB patients were excluded from the study. A pre-tested interviewer administered questionnaire was used in Hindi language to collect data from study participants. The questionnaire included questions on socio-demographic characteristics; information related to TB and anemia. This was followed by a general physical examination, anthropometric assessment and systemic examination of the study participants. Blood was collected from the cubital vein, with the help of 26 Gauge needle and a vacutainer and then transferred into an EDTA coated vial. Hemoglobin (Hb) was measured by Hematology Automated Analyser and peripheral smear was done by thin blood smear.

Anemia is defined as hemoglobin <13 g/dl (males) or <12 g/dl (female). Anemia was further categorized according to severity with the following hemoglobin cut off points: mild anemia; 11.00 – 13 g/dl (male) and 11.00 – 12 g/dl (female); moderate anemia 8.00 – 11 (both sexes); severe anemia hemoglobin less than 8 g/dl for both sexes as per WHO guidelines.[15]Data was entered and analysed in MS Excel to calculate frequencies, mean, range etc. Approval from Institutional Ethical Committee of VMMC & Safdarjung Hospital. Written informed consent from the TB patients were taken before the start of the study. The TB patients with iron deficiency were counseled about the diet, started on iron therapy and those who required specialist care for management were referred either to VMMC and Safdarjung Hospital, New Delhi; or to Rao Tula Ram Memorial Hospital, Jaffarpur, which is the nearest health care center from the place of study.

RESULTS

The study was conducted among 200 newly diagnosed Tuberculosis patients.

Table 1. Distribution of study participants based on Socio-demographic profile (N=200)

S. No.	Socio-demographic profile of study participants	Number (%)
I	Sex	
1	Male	125 (62.5)
2	Female	75 (37.5)
II	Educational status	
1	Illiterate	62 (31)
2	Primary school	46 (23)
3	Middle school	37 (18.5)
4	High school	25 (12.5)
5	Higher secondary school	26 (13)
6	Graduate/ post graduate	4 (2)
III	Occupation	
1	Gainfully employed	64 (32)
2	Unemployed	136 (68)
IV	Socio economic class (Modified B.G. Prasad's scale, May 2014)	
1	I	8 (4)
2	II	34 (17)
3	III	86 (43)
4	IV	67 (33.5)
5	V	5 (2.5)
	TOTAL	200 (100)

Socio demographic characteristics: The age of the participants ranged from 15 to 76 years and the median age was 30 years. Majority (98%) of study participants were Hindu by religion. A total of 136(68%) were unemployed. Forty-three (21.5%) study participants were house wives while 39(19.5%) were students. Among the employed, majority (32, 16%) were unskilled workers. Half of them (106, 53%) belonged to

nuclear family and overcrowding was present in families of 129 (64.5%).

Substance use: Out of the 200 study participants, 102 (51%) were current smokers, 115 (57.5%) were current users of smoke less form of tobacco and 94 (47%) were current user of alcohol in any form.

History of TB contact: Out of 200 study participants, 69(34.5%) gave history of contact with TB infection either among family members or neighborhood and none reported history of contact in both. On being enquired about presenting symptoms related to TB and anemia, cough for more than 2 weeks was reported by all the study participants followed by loss of weight (183,91.1%) and shortness of breath (116, 58%).

Dietary history: Out of 200 study participants, 86 (43%) were vegetarian whereas, 114 (57%) were non-vegetarian who consumed Red meat. None of the study participants were on iron supplements or steroids or immunosuppressant at the time of interview.

Out of 75 female study participants, 65 (86.67%) were menstruating. All of them had regular cycles and menopause was attained by 10 (13.33%).

Anemia was found in 151 (75.5%) of the study participants at the start of Intensive phase and in 99 (49.5%) of the study participants at the end of Intensive phase. The mean Hb was 11.16(±1.97) g/dl (minimum = 6.9 g/dl and maximum = 17.1 g/dl) at the start of Intensive phase and was 12.2(±1.63) g/dl (minimum = 7.9 g/dl and maximum = 16.4 g/dl) at the end of Intensive phase. Among males, the mean Hb was 11.7(±2.04) g/dl (minimum = 7.4 g/dl and maximum = 17.1 g/dl) at the start of Intensive phase and was 12.6 (±1.7) g/dl(minimum = 7.9 g/dl and maximum = 16.4 g/dl) at the end of Intensive phase. Among females, the mean Hb was 10.3 (±1.36) g/dl(minimum = 6.9 g/dl and maximum = 13.6 g/dl) at the start of Intensive phase and was 11.4 (±1.2) g/dl(minimum = 9.0 g/dl and maximum = 14.0 g/dl) at the end of Intensive phase. Out of these 151 anemic study participants at the start of Intensive phase, 101 (66.9%) had mild anemia, while 35 (23.2%) had moderate and 15 (9.9%) had severe anemia. Out of these 99 anemic study participants at the end of Intensive phase, 73 (73.7%) had mild anemia, while 24 (24.3%) had moderate and 2 (2%) had severe anemia.

Most common type of anemia was Normocytic anemia followed by microcytic anemia and macrocytic anemia, both at the start and the end of intensive phase.

DISCUSSION

In the present study, the prevalence of anemia was 75.5% at the start of intensive phase. This result is similar to the studies conducted by Yarnal et al. (2013) Thatoi and Khadanga (2013) Bhargava et al. (2013) Nagu et al. (2014) Minchella et al. (2015) Oliveira et al. (2014) and Isanaka et al. (2012) where the prevalence of anemia was high among tuberculosis patients. In a study by Atomsa D in 48 pulmonary tuberculosis patients, the prevalence of anemia was 45.8%. (Atomsa et al., 2014) This difference in the prevalence of anemia may be because of the smaller sample size in this study compared to ourstudy which would limit their power to detect small difference if any.
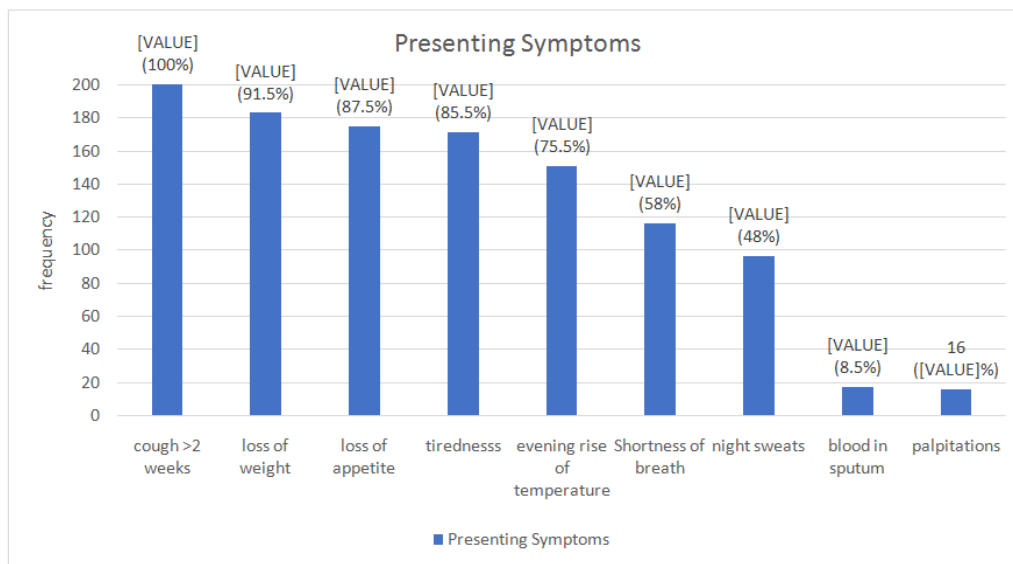
*multiple responses possible

Figure 1. Distribution of study participants based on presenting symptoms related to Tuberculosis and Anemia at the start of intensive phase of treatment (N=200)

Table 2. Distribution of study participants based on Hemoglobin levels (N=200)

S. No.	Characteristics (*WHO criteria)	At the start of the intensive phase, n (%)			At the end of the intensive phase, n (%)		
		Male	Female	Total	Male	Female	Total
I	ANEMIA						
1	No anemia	41 (67.2)	8 (10.7)	49 (24.5)	71 (56.8)	30 (40)	101 (50.5)
2	Anemia	84 (32.8)	67 (89.3)	151 (75.5)	54 (43.2)	45 (60)	99 (49.5)
	Total	125 (100)	75 (100)	200 (100)	125 (100)	75 (100)	200 (100)
II	GRADES of ANEMIA						
1	Mild	62 (73.8)	39 (58.2)	101 (66.9)	41 (75.9)	32 (71.1)	73 (73.7)
2	Moderate	12 (14.3)	23 (34.3)	35 (23.2)	11 (20.4)	13 (28.9)	24 (24.3)
3	Severe	10 (11.9)	5 (7.5)	15 (9.9)	2 (3.7)	0	2 (2.0)
	Total	84 (100)	67 (100)	151 (100)	54 (100)	45 (100)	99 (100)

Table 3. Distribution of Anemic study participants based on the type of Anemia on peripheral smear

S. No.	Type of Anemia	At the start of intensive phase, n (%)	At the end of intensive phase, n (%)
1	Normocytic	91 (60.3)	61 (61.6)
2	Microcytic	55 (36.4)	37 (37.4)
3	Macrocytic	5 (3.3)	1 (1)
	Total	151 (100)	99 (100)

In the study by Lee SW among 880 tuberculosis patients, the prevalence of anemia was 32%. (Lee *et al.*, 2006) This difference in the prevalence of anemia in the present study and the above said study may be because the latter study had excluded the patients due to other causes of anemia and included only the tuberculosis associated anemia. In the present study, most common type of anemia was Normocytic anemia (60.3%) followed by microcytic anemia (36.4%) and macrocytic anemia (3.3%). The study by Yarnal PJ in 100 Tuberculosis patients revealed that the Normocytic anemia was the most common type (66.2%) and followed by microcytic anemia (29.7%) and macrocytic anemia (3.8%). (Yaranal *et al.*, 2013) The study by Thatoi among 100 Tuberculosis patients revealed that the most common type of anemia was Normocytic anemia (66%) followed bymicrocytic anemia (30%) and macrocytic anemia (4%). (Thatoi and Khadanga, 2013) In a study by Lee SW among 880 tuberculosis patients revealed that the most common type of anemia was normocytic anemia (71.9 %) followed by microcytic anemia (9.1 %). (Lee *et al.*, 2006) In a study by Kumar Samong 63 pulmonary Category I patients revealed that the most common type of

anemia was normocytic anemia (86 %) followed by microcytic anemia (14 %). (Kumar *et al.*, 2013) There is similarity in type of anemia in the present study and the above mentioned studies.

Conclusion

To conclude from our study, three out of four newly diagnosed tuberculosis patients were anemic at the time of diagnosis of tuberculosis. TB-associated anemia is usually mild and improves with anemic treatment along with anti-TB treatment. It is recommended that the universal screening for anemia at the time of diagnosis of tuberculosis should be done to improve the treatment outcome of the tuberculosis patients. Hence, not only the anti-tuberculosis drug therapy, but a multi-pronged strategy which takes treatment for anemia into consideration can help in prevention and control of tuberculosis infection in India.

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Conflicts of interest

There are no conflicts of interest.

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