Original Article

A study of anemia with respect to severity of tuberculosis

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Abstract

Background: Tuberculosis (TB) may produce abnormalities in the peripheral blood, including anemia. TB and anemia are both prevalent in India. There is limited and inconsistent literature on the association between anemia and pulmonary tuberculosis in the studied area. This study aimed at assessing the anemia among patients with respect to severity of tuberculosis. **Material and Methods:** The study subjects included 100 patients above 12 years of age without co-morbidities of newly diagnosed cases of pulmonary and extra pulmonary tuberculosis diagnosed. Anemia was defined as per WHO recommendations as hemoglobin concentration less than 13 g/dL in men and 12 g/dL in women. **Results:** Out of the 100 cases of tuberculosis collected from our hospital, 55 patients were PTB, and 45 were of extra-pulmonary tuberculosis. Anemia was identified in 71 patients (71%) at the time of diagnosis of TB. In 38 patients, the hemoglobin concentration was less than 10 g/dL. Normocytic and normochromic anemia was most common, and was identified in 71.83% anemic patients; and microcytic hypochromic anemia was next common (19.71%). The presence of anemia was associated with age older than 62 years and female sex. **Discussion:** Anemia was found to be the common hematological condition associated with pulmonary TB and a strong predictor of mortality and disease progression.
Keywords: Tuberculosis, anemia, severity, haemoglobin.

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INTRODUCTION

Anemia is considered to be present if the hemoglobin concentration (Hb) of the red cells is below the lower limit of the 95% reference interval for the individual; age, sex, and geographic location[1]. Nearly one-quarter of the world's population, are anemic, a condition characterized by a lower than normal hemoglobin concentration in the blood[2]. Many studies have documented a high prevalence of anemia among TB patients [32–86%[3-7] and there is some evidence to suggest that anemia at TB diagnosis is associated with an increased risk of death[8-10]. A variety of haematological changes have been described in patients with PTB such as anemia, increased erythrocyte sedimentation rate, low serum albumin level and leukocytosis[11]. Anemia is a common complication of pulmonary tuberculosis. The precise mechanism of anemia in pulmonary tuberculosis is not clearly known although, anemia due to inflammation as well as of iron deficiency has been implicated, both are common in developing countries[12,13]. Anemia can develop as a secondary effect of a disease process that does not physically invade the bone marrow or markedly accelerated the destruction of erythrocyte. The extent of anemia associated with tuberculosis depends on the extension of the disease. When tuberculosis is localized mainly in one organ e.g. the lung, the hemoglobin level is usually normal until the disease has made considerable progress leading to a mild to moderate normochromic normocytic, or a slightly hypochromic anemia. The anemia takes several weeks to develop after the onset of infection, and then progresses slowly over several months until the hemoglobin level eventually stabilizes[14].

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Nutritional deficiency and malabsorption syndrome can deepen the severity of anemia. The increasing prevalence of anemia with age has been explained by increased chronic disease, poor nutritional status, decrease marrow cellularity, and low serum B12 level. Therefore, old age could be considered as a risk factor for tuberculosis associated anemia. The effect of iron –retention might be exaggerated in women with tuberculosis because women are more likely than men to be iron deficient. This can explain female sex is a risk factor of anemia[12]. The deficiency is equally common among treated and untreated patients, and it is not related to the length or type of antituberculous. Malabsorption, increased utilization of folate occurs in tuberculosis owing to chronic inflammation, and this increased demand cannot be met by an ordinary diet. Although several studies have shown significantly lower levels of serum folate in patients with active tuberculosis when compared with controls the incidence of significant megaloblastic anemia is low[3]. The present study was designed to find out the prevalence of anemia and its relation with severity of tuberculosis.

MATERIAL AND METHODS

The study subjects included 100 patients of newly diagnosed cases of pulmonary and extra pulmonary tuberculosis diagnosed between October 2006 to October 2008 in the Medicine and Chest TB department of Mahatma Gandhi Mission's Medical College, New Mumbai. The inclusion criteria were patients first time diagnosis, no current or previous anti-tuberculous drug treatment, and not to be suffering from any other chronic disease. The exclusion criteria included past history of pulmonary TB, currently on antituberculous drug or any other drugs which affected bone marrow or peripheral blood, and known at the time of study to have a chronic disease which will adversely affect the body systems including the bone marrow and the peripheral blood. Detailed clinical history and physical examination was done of all the enrolled patients. Pulmonary TB patients were diagnosed on the basis of positive sputum smears for acid fast bacilli (AFB), and /or radiographic reports, skin tests and positive culture reports. For extra pulmonary TB, detection of AFB in the samples, radio-imaging reports, skin tests and positive culture reports were taken into account. Data was collected pertaining to demographics and past history of contact with, or treatment for TB, Skin test results, bacteriologic studies, radiographic reports, and symptoms upon presentation were also assessed for each subject. Blood samples were collected from all of the studied population. About 3 ml blood was placed in potassium ethylene diamine tetra acetic acid (EDTA) and 3 ml in plain container. The samples under standard laboratory temperature were processed to obtain serum by using a centrifuge. The analysis was done in department of pathology. The definition of anemia used in this study was hemoglobin concentration less than 13 g/dL in men and 12 g/dL in women (WHO recommendation)[2]. The resolution of anemia was defined as a hemoglobin concentration greater than 13 g/dL in men and 12 g/dL in women following two tests more than a month apart.

RESULTS

A total of 100 patients newly diagnosed as pulmonary and extra pulmonary TB were enrolled in this present study. Out of the 100 cases of tuberculosis collected from our hospital, 55 patients were PTB, of which 11 had mild, 23 moderate and 21patients were found to have severe lung disease. Among the 45 cases of EPTB, 29 cases had pleural effusion, 11 had disseminated TB, 3 had abdominal TB and 2 cases of TB lymophadenopathy were seen. Of the 29 cases of effusion 9 had associated lung parenchyma involvement. 4 cases of disseminated TB had evidence of TB meningitis. Forty out of 55 cases of pulmonary TB were male patients. Similar trend was seen in mild, moderate and severe lung involvement. Among pleural effusion 15 were male and 14 female patients. 1 male and 2 female patients had abdominal involvement. Both cases of TB lymphadenitis were female. Out of the 11 cases of miliary or disseminated TB, 9 were cases of miliary TB. Pulmonary TB was the most common form of TB (Table 1). All the patients were treated with isoniazid, rifampicin, pyrazinamide, and ethambutol and the median treatment period was 212 days.

Table 1: Symptom wise distribution of patients (n=100)

Total number	100
Male: Female	64:34
Mean Age (years)	44
Types of TB	
Pulmonary	29
Miliary	11
Abdominal TB	03
TB lymph node	02

Anemia was identified in 71 patients (71%) at the time of diagnosis of TB. 43 of 64 (67.18%) men and 28 of 36 (77.77%) women with TB had anemia. In 38 patients, the hemoglobin concentration was less than 10 g/dL. No male patient had a hemoglobin concentration less than 6.9 g/dL although 4 female patient had a hemoglobin concentration less than 6.9 g/dL (Table 2). Normocytic and normochromic anemia was most common, and was identified in 51 of 71 (71.83%) anemic patients; and microcytic hypochromic anemia was next common (14 patients, 19.71%). The presence of anemia was associated with age older than 62 years and female sex.

Table 2: Distribution of hemoglobin concentrations in patients with tuberculosis

Hemoglobin concentration	Male	Female	Total
<6.9	00	04	04
7.0-9.9	16	18	34
10.0-11.9	11	06	17
12-12.9	16	03	19
>13.0	21	05	27

DISCUSSION

Various studies have shown anemia to be one of the commonest manifestation of TB[22,24]. However, the reported incidences have varied widely from 16–94% of patients with PTB, although, different definitions of anemia were probably applied and the cases were not necessarily freshly diagnosed. Anemia occurred in 71% of our patients, however, TB- associated anemia completely resolved with anti-TB treatment in 64.5% of patients. In addition, the anemia improved considerably in the other patients. All chronic infections including TB can cause anemia[15]. Various pathogeneses have been suggested in TB-associated anemia, but most studies have shown suppression of erythropoiesis by inflammatory mediators[16-20] as a cause of anemia. Nutritional deficiency[21] and malabsorption syndrome[22] can deepen the severity of anemia. Although a normocytic, normochromic anemia was most common in this study, other types of anemia, including hypochromic microcytic anemia, were not rare. Considering the diverse morphology of anemia and various suggestions for the cause of TB-associated anemia, the anemia in patients with TB may result from several mechanisms instead of one sole pathogenesis. Female sex and old age were risk factors for TB-associated anemia in our data. The prevalence of anemia usually increases with age, especially after age 60 years[23,24]. The increasing prevalence of anemia with age has been explained by increased chronic disease, poor nutritional status, decreased marrow cellularity and low serum vitamin B12 levels. In this context, old age could be interpreted as a risk factor for TB-associated anemia. Iron retention, erythropoietin response, nutritional state, and malabsorption can improve, as inflammation and burden of organism decreases by anti-TB medication. This can explain good treatment response showed tendency toward resolution of anemia with marginal statistical significance in our study. In conclusion, anemia was found to be the common hematological condition associated with pulmonary TB and a strong predictor of mortality and disease progression. Anemia usually resolves with anti-TB treatment therefore close observation is sufficient without other cause of the anemia.

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