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EVOLUTION OF ANAEMIA IN PULMONARY TUBERCULOSIS PATIENTS ON ANTI-TUBERCULOSIS THERAPY

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ABSTRACT

Anaemia of chronic disease (ACD) is a form of anaemia seen in chronic illnesses such as in active pulmonary tuberculosis (TB) patients. In such cases, iron is sequestered in macrophages limiting availability to invading organisms in a bid to control the infection. Our research bordered on finding out if the anaemia will be resolved as tuberculosis treatment proceeds, without need for iron-rich supplements. We recruited 110 active pulmonary tuberculosis patients and 110 age- and gender-matched apparently healthy controls to this study and compared their haemoglobin concentration values. The tuberculosis patients were further grouped into 3: Group 1 comprising of newly diagnosed patients before start of treatment; Group 2 comprised of TB patients 2 months after start of treatment, and Group 3 had patients 6 months after start of treatment. The haemoglobin concentration of patients in each group were compared to the controls. This study found a significantly lower haemoglobin concentration in TB patients across all age groups and gender when compared to the controls (P-value<0.05). The mean haemoglobin concentration (g/dl) in Groups 1-3 were 7.58±0.48, 10.58±2.26 and 13.46±3.40 respectively, showing a gradual increase in haemoglobin concentration as treatment proceeded. A comparison of haemoglobin concentration in Group 3 patients with the controls was not statistically significant (P-value=0.504) showing that anaemia had been completely resolved. We conclude that anaemia is an accompanying feature of pulmonary tuberculosis but can be resolved by treating the primary disease without need for iron-supplements.

KEYWORDS: Pulmonary tuberculosis, Anaemia of Chronic disease, Haemoglobin.

INTRODUCTION

Tuberculosis is one of the world's most chronic infectious disease and the most common cause of death in HIV patients in emergent nations.[1] Effective chemotherapy for tuberculosis is complex because drugs that kill the active growing bacterium have no effect on those in the latent phase, and the bacterium could develop resistance to the drugs [2].

Diverse haematological abnormalities have been reported in pulmonary tuberculosis patients such as anaemia and leucocytosis.[3,4] Invasion of the body by bacteria such as Mycobacterium tuberculosis, causative agent of pulmonary tuberculosis, leads to activation of the inflammatory cytokine, Interleukin-6 (IL-6). IL-6 increases production of hepcidin which blocks the export of iron from the hepatocytes and macrophages, limiting its availability for haemoglobin synthesis.[5,6]

This project is aimed at finding out if anaemia is ameliorated as anti-tuberculosis therapy proceeds without the need for iron-rich supplements.

MATERIALS AND METHODS

Setting

This study was carried out in the Tuberculosis Centre of Plateau State Specialist Hospital, Nigeria. Ethical approval was obtained from the Plateau State Specialist Hospital Committee.

Study Design

This was a cross-sectional comparative study. The patients were randomly selected and included 110 active pulmonary tuberculosis patients who were not receiving iron-supplements (67 males and 43 females) within the age bracket of 15 and 65 years. 110 apparently healthy individuals were also recruited into the study as controls (55 males and 55 females). Sputum samples were collected for confirmation of acid fast bacilli in the test subjects. Blood samples were collected for haemoglobin estimation.

Sample Analysis

Sputum samples used for confirmation of pulmonary tuberculosis were stained with Ziehl-Neelsen stain and observed microscopically for acid-fast bacilli.

Haemoglobin concentration was measured manually using Drabkin's solution following a laid down procedure.[7]

Data Analysis

Data analysis was done using SPSS version 16.0 (Statistical Package for Social Sciences. Inc., Chicago, III). Descriptive data were represented as means±SD. The Pearson Chi squared test was used for assessment and p-values <0.05 was considered significant. Haemoglobin concentration among confirmed tuberculosis patients and healthy controls were compared among the sexes and across the different age groups: ≤20, 21-25, 26-30, 31-35, 36-40 and ≥40 years. Tuberculosis patients were separated into 3 groups. Group 1 had newly diagnosed patients (before start of treatment). Group 2 comprised of patients that are in the intensive phase of treatment, recruited 2 months after commencement of therapy. Group 3 patients were in the continuous phase of treatment and were 6 months into treatment. Haemoglobin concentrations for each group were also compared to the healthy controls.

RESULTS AND DISCUSSION

Tables 1 shows the relationship between haemoglobin concentration and age and gender among the study subjects.

Table 1: Haemoglobin Concentration in Study Subjects in Relation to Age Group and Gender.

Parameter		Control (g/dl)	Test (g/dl)	P-Value
Age Group	≤20	14.63±1.42	10.52±2.95	0.018
	21-25	13.60±1.17	10.91±2.64	0.000
	26-30	13.74±1.06	9.57±2.09	0.000
	31-35	14.30±2.00	9.89±2.71	0.017
	36-40	14.20±0.46	9.73±2.59	0.009
	≥40	13.30±0.47	10.93±2.78	0.007
Gender	Male	14.29±1.13	10.80±2.47	0.000
	Female	13.09±0.76	9.35±2.33	0.000

Values are expressed as means and standard deviations
Results are significant at $p < 0.05$

The findings shown in table 1 demonstrate a significantly lower haemoglobin concentration in pulmonary tuberculosis when compared to age-matched and gender-matched controls. This corresponds with available literature that states that occurrence of anaemia among patients that were diagnosed with active pulmonary tuberculosis was high and contributed to anaemia of chronic disease.[8-10] Infections induce iron sequestration in macrophages, and decrease iron absorption from the small intestine, limiting its availability to invading bacteria. The diversion of iron to stores is due to the action of cytokines on the iron-regulating peptide, hepcidin, which retains iron in the macrophages, instead of being released in the plasma, acting as part of the body's immune system. Unfortunately, this diversion of iron from the circulation into stores limits the availability of iron for erythropoiesis, leading to development of anaemia.[6,8]

As anti-tuberculosis therapy went on, there was a gradual improvement in the haemoglobin concentration when compared to the healthy controls as shown in table 2. Group 1 consisted of newly diagnosed patients before starting treatment. Patients in Group 2 were in the intensive phase of treatment, 2 months from starting treatment. Group 3 patients were in the continuous phase of treatment, 6 months after start of treatment.

Table 2: The haemoglobin Concentration Values of Therapy Groups and Healthy Controls.

Groups	Control	Test	P-value
Group 1	13.69±1.13	7.58±0.48	0.000
Group 2	13.69±1.13	10.58±2.26	0.000
Group 3	13.69±1.13	13.46±3.40	0.504

Values are expressed as means and standard deviations.
Results are significant at $p < 0.05$.

The results indicated that Group 1 and Group 2 patients had significantly lower haemoglobin concentration than the healthy control test subjects. However, the mean haemoglobin concentration in Group 2, though not statistically significant, showed an improvement when compared to the Group 1 patients. 6 months into treatment, Haemoglobin concentration increased so much so that there was no statistical significant difference when compared to the healthy controls. The rise in haemoglobin concentration is a marker reflecting response to treatment of the primary cause of anaemia, pulmonary tuberculosis. Anaemia of chronic disease is often difficult to distinguish from iron deficiency anaemia. Our study show that anaemia can be reversed without the need for iron supplements. It has been shown that iron supplementation can improve mild to moderate anaemia in pulmonary tuberculosis patients. However, this improvement was consistent only based on improvement of the primary disease process, pulmonary tuberculosis.[11] Consistent use of iron-rich supplements in pulmonary tuberculosis cases could, in fact, lead to disease relapse.[12]

CONCLUSION

We conclude that anaemia is an accompanying feature of pulmonary tuberculosis. Managing the primary disease leads to a resolve of the anaemia and therefore, trying to treat anaemia with iron supplements may not be necessary.

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