Abnormalities of hematological parameters in newly diagnosed Pulmonary tuberculosis patients in Kirkuk city

Hager Ali Shareef
University of Kirkuk-college of Science- Dept of biology
Nizar Ramadan M. Amin
Azadi general hospital

Abstract
Tuberculosis (TB) is a public health problem in Kirkuk city. This study describes differences in hematological parameters in 30 patients (15 male and 15 female) with untreated pulmonary tuberculosis (PTB) and compared them with those of 30 normal age and sex-matched controls. The results showed that the patient had significantly lower hemoglobin levels than the healthy group but no significant differences was observed between males and females. A significant differences in red blood cell parameters including Mean cell hemoglobin (MCH), Mean cell hemoglobin concentration (MCHC), and Mean cell volume (MCV) in patients group, and these differences were more frequently in males than in females. Regarding leukocyte indices, no differences observed in mean total white blood cell count, neutrophils, monocytes and lymphocytes between all patients and healthy group. Another interesting observation was abnormal platelet count (PLT) which was significantly higher in patients than those of healthy group. In conclusion the most common hematological abnormalities observed in Kirkuk PTB patients was Normocytic normochromic anemia and thrombocytosis (high platelet count).

Introduction
Tuberculosis (TB) is a highly prevalent chronic infections disease caused by Mycobacterium tuberculosis, an aerobic intracellular binding bacterium, because of this characteristic it prefers tissues which always in contact with high oxygen levels, as in the lung. Inhalation of single viable organis has been shown to lead to infection, although close contact is usually necessary for acquisition of infection. The disease usually occurs after some years after the initial infection, when the patients b system breaks down for some reason other than the presence of tuberculosis bacilli within the lung (Forbes et al., 2007; Oliva, et al., 2008).
Tuberculosis remain at epidemic levels, particularly in developing countries. An estimated 1.7 billion persons, one third of the world's population are infected with *M. tuberculosis*, this reservoir of infected individuals results in 8 million new cases of tuberculosis and 3 million deaths annually from Pulmonary tuberculosis (PTB) (Forbes et al., 2007; Oliva, et al., 2008).

The diagnosis of TB mainly relies on acid-fast bacilli smear and culture results (Gladwing & Trattler, 2007). The delay of diagnosis in some cases was attributed to the PTB, because the PTB was presented in the form of multiple nodules through the lungs (Jang et al., 2009). Active PTB may produce signs and symptoms that include hematological abnormalities, hyponatremia and psychological disorders (Crofton et al., 1992; AL-Omar& Oluboyede, 2002; Awodu et al., 2007). The most common hematological manifestation of Pulmonary tuberculosis are anemia, iron deficiency and increases in the peripheral blood leucocyte (Bozoky, 1997). Studies have documented a close correlation between acid-fast bacilli in sputum and hematological abnormalities and revealed that abnormal hematological values are useful indicators and may aid in diagnosis of severity in TB (Morris, 1989; Bozoky, 1997; Singla et al., 2003).

**Objective:**

Hematological abnormalities associated with TB infection have been incompletely investigated. To the best of our knowledge, there is no comprehensive study assessing the hematological abnormalities in Kirkuk patients suffering from pulmonary tuberculosis.

**Material and Method**

Thirty patients (15 males and 15 females) were diagnosed with pulmonary TB from December 2008 to March 2009. The ages of the patients ranged from 15-70 years old, with an average age of (33.8) years old. A healthy control group (n=30, 15 males and 15 females) with an average age of (31.6) years old was included in the study.

Pulmonary TB was defined as being sputum smear positive in at least two microscopic examination; or sputum smear positive in one microscopic examination plus positive culture or abnormal chest X-ray consistent with TB. PTB was also defined as being sputum smear negative but culture positive or with an abnormal chest X-ray consistent with TB (Nimfa et al., 2002).

**Bacteriological analysis for PTB diagnosis**

Sputum samples were collected from patients with respiratory symptoms, smears were stained by the Ziehl-Neelsen direct method, for each patient two microscopical examination was done.

**Blood sample analysis**

Venous blood samples were obtained from patients and healthy persons, for the analysis of blood samples this instrument was used: Coulter counter (model Cell tac E (NIHON KOHDEN -Japan)). The analysis was performed in the central laboratory at the Kirkuk general hospital.

The parameters reported by the model Cell tac E are: hemoglobin (Hb g/dl), red blood cell (erythrocyte count, RBC) number of erythrocytes in the specified volume of whole blood (Units of measure are 10¹² cell/L) and red blood cell parameters: Mean cell volume (MCV femtoliters (fl)), Mean cell hemoglobin (MCH picograms (pg)) and Mean cell hemoglobin concentration (MCHC g/dl). Also White blood cell (leucocyte count, WBC) number of leucocytes (neutrophils, monocytes and lymphocytes) in the specified volume of whole blood (Units of measure are 1⁹ cell/L).
Results and discussion
Hemoglobin (Hb) and Hematocrit (HCT)

The Hb and HCT values are shown in table (1). The mean of Hb was significantly decreased in patient group (12±2.8) in comparison to healthy group (15.18 ±1.13). Also the Hematocrit percentage was decreased in the patient group (36.44±7.61), but it did not reach statistical significance when compared with healthy individuals (44.76 ±3.43).

In order to investigate if there is difference of the Hb levels between males and females among the patient group, the study of the Hb was carried out by the sex, and the results showed non- significant differences of the mean Hb concentration between males (13.16 g/dl) and females (10.3 g/dl), but both values were significantly lower than the mean values for healthy males and females (15.6 g/dl) and (14.74 g/dl) respectively (table- 2).

The variant values demonstrated that the distribution of Hb concentration and Hematocrit ratio were skewed toward the lower values. However literature review showed that the mean Hb and HCT in Nigerian, Indian, Malaysian and Saudian pulmonary TB patients were much lower than the values found in the current study (Akintunde et al., 1995 ;Singh et al., 2001 ; Araujo et al., 2003 ; Muzaffar et al., 2008 ; AL-Omar et al., 2009 ). Amild anemia was observed in some patients in this study, this observations are in agreement with the earlier erports which are demonstrating that the mild anemia to be a common features in pulmonary TB patients, also anemia due to inflammation and iron deficiency has been implicated ( Ebrahim et al.,1995 ; Das et al., 2003 ; Lee et al.,2006 ; Miah et al.,2007 ).

Red blood cell parameters

The red cell parameters values which include the mean values for mean cell hemoglobin concentration (MCHC), mean cell hemoglobin (MCH) and mean cell volume (MCV) for all patients and healthy persons are measured and shown in table 1. All patients, especially males were presented significantly lower concentration of MCHC[32.32±1.32,(32.1±0.92 male and 32.54±1.7 female)] as compared to control group [33.92±0.34,(34.1±0.26 male and 33.74±0.35 female)].this finding is similar to study by Araujo et al.,(2003). It has been reported that the lower MCHC values may be associated with adeficiency of iron which may be acquired through extrinsic factors, for example malnutrition (Wessels et al.,1999;Araujo et al.,2003).

A significant difference of the MCV and MCH was found in male patients (79.42±2.4 and 25.94±1.92 respectively jas compared to the healthy males (88.04±2.5 and 30.1±0.9 respectively. However in female patients the values obtained were non-significant in comparison to healthy persons.

From the results mentioned above, we observed that the normocytic normochromic anemia was the most common hematological abnormality in majority of Kirkuk Pulmonary TB patients, while only 20% of the patients had microcyte hypochromic anemia (such patient had lower MCV and MCH values). Generally, literature review demonstrated that the anemia in chronic diseases is of normocytic normochromic type, although in a few cases, microcytic hypochromic also occurred (Jenkins & Williams,.1994 ; Wickramasinghe,2000 ; Iolascon et al.,2009). However, our findings are supported by earlier and recent studies which they found hematological abnormalities among their patients with pulmonary TB included normocytic normochromic anemia (Morris et al.,1989; Dosumu.,2001; Shigh et al.,2001; Olaniyi&Akenova,2003; Lee et al.,2006; Muzaffar et al.,2008). AL-Omar and his workers(2009) also observed significant hematological abnormalities in Saudi PTB patients, and among them 80% was having normocytic normochromic anemia while only 20% had microcytic hypochromic anemia.
Total white blood cell (WBC) and differential count

Total white blood cell and differential counts in Kirkuk Pulmonary TB patients were also investigated. As shown in table (1 and 2), no significant differences was observed in total WBC counts, neutrophils, monocytes and lymphocytes between all patients and healthy group. These observations agree with previous studies (Wessels et al., 1999; Singh et al., 2001), but contradictory to some of the results in other studies that indicating hematological abnormalities of the white blood cell include leucocytosis or leucopenia, neutrophilia or neutropenia, lymphocytosis or lymphopenia and monocytosis or monocytopenia in their patients with PTB (Morris et al., 1989; Akintunde et al., 1995; AL-Buhairan, 1998; Olaniyi and Akenova, 2003; Awodu et al., 2007; Sobiecka et al., 2008; AL-Omar et al., 2009).

Platelet count

The count of platelets is shown in table (1 and 2). The patients group presented increase of platelets count (355.9±116.9) which were significantly higher in comparison to the healthy group (258.2±66.51). This finding showed thrombocytosis in patients which was found relatively higher in male patients (364.6±54.75) ascompared to female patients (347.2±166.07). This result is similar to studies by (Kartaloglu et al., 2001; Awodu et al., 2007; Venom, 2008; AL-Omar et al., 2009). Also in study by Singh et al. (2001) he found thrombocytosis more common than thrombocytopenia in patients with PTB. Some researchers found reactive thrombocytosis in anumber of clinical situations including infectious diseases such as PTB (Wickramasinghe, 2000; Unsal et al., 2005). The cause of thrombocytosis in PTB patients in our study might be attributed to an immune phenomenon due to production of platelet antibodies which leads to reactive myeloid hyperplasia (Baynes et al., 1987; Akintunde et al., 1995).

Several studies demonstrated that the hemoglobin level, white blood cell count, red blood parameters, erythrocyte sedimentation rate, high platelet count and body weight loss are useful indices of severity in tuberculosis, and the return of these indices to normal level is a good indication of disease control in that they correlate with sputum conversion to acid-fast bacilli negative (Morris., 1989; Olaniyi and Akenova., 2003; Muzaffar et al., 2008). Hematological and biochemical abnormalities in pulmonary TB are common and may be valuable aids in diagnosis.

Conclusion

Based on the varied hematological abnormalities observed in Kirkuk patients with pulmonary TB, we suggest that the differential diagnosis of tuberculosis should be entertained in patients with varied hematological disorders.
Table 1:- Hematological parameters including Hb , HCT , RBC , MCV , MCH , and MCHC . Also values of total of white blood cell count and differential and values of platelet in all patients and healthy group .

<table>
<thead>
<tr>
<th>parameters</th>
<th>Patients (n=30) Mean± SD</th>
<th>Healthy group(n=30) Mean± SD</th>
<th>P- values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (g/dl)</td>
<td>12± 2.8</td>
<td>15.1± 1.13</td>
<td>0.0038 **</td>
</tr>
<tr>
<td>HCT (%)</td>
<td>36.44± 7.6</td>
<td>44.76± 3.43</td>
<td>0.179 (NS)</td>
</tr>
<tr>
<td>RBC (x 10^{12}/L)</td>
<td>4.62± 1.1</td>
<td>4.95± 0.21</td>
<td>0.358 (NS)</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>81.31± 13.8</td>
<td>86.03 ± 3.21</td>
<td>0.308 (NS)</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>26.53± 5.17</td>
<td>29.5 ± 1.15</td>
<td>0.0934 (NS)</td>
</tr>
<tr>
<td>MCHC (g/dl)</td>
<td>32.32 ± 1.32</td>
<td>33.92± 0.3</td>
<td>0.00164 **</td>
</tr>
</tbody>
</table>

Table 2 :- Values of hematological parameters , total and differential of white blood cell count (WBC) and values of platelet count in male and female patient suffering from pulmonary TB .

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Males Patients(n=15) Mean± SD</th>
<th>female Patients(n=15) Mean± SD</th>
<th>P-values</th>
<th>Female Patients(n=15) Mean± SD</th>
<th>Female Patients(n=15) Mean± SD</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (g/dl)</td>
<td>13.16 ± 1.82</td>
<td>15.62 ± 1.19</td>
<td>0.035</td>
<td>10.84± 3.34</td>
<td>14.74 ± 0.39</td>
<td>0.036*</td>
</tr>
<tr>
<td>HCT(%)</td>
<td>39.74 ± 4.64</td>
<td>46.86± 2.75</td>
<td>0.01***</td>
<td>33.14± 9.03</td>
<td>42.66± 2.8</td>
<td>0.05****</td>
</tr>
<tr>
<td>RBC(x 10^{12}/L)</td>
<td>5.02 ± 0.54</td>
<td>4.99 ± 0.19</td>
<td>0.911</td>
<td>4.22± 1.41</td>
<td>4.9± 0.24</td>
<td>0.311</td>
</tr>
<tr>
<td>MCV(fl)</td>
<td>79.42 ± 2.47</td>
<td>80.04± 2.55</td>
<td>0.0006**</td>
<td>83.2± 20.44</td>
<td>84.02± 2.58</td>
<td>0.931( NS)</td>
</tr>
<tr>
<td>MCH(pg)</td>
<td>25.94 ± 1.92</td>
<td>30.1 ± 0.9</td>
<td>0.0023**</td>
<td>27.12± 7.46</td>
<td>28.9± 1.14</td>
<td>0.612( NS)</td>
</tr>
<tr>
<td>MCHC (g/dl)</td>
<td>32.1 ± 0.92</td>
<td>34.1± 0.26</td>
<td>0.0016**</td>
<td>32.54± 1.71</td>
<td>33.74± 0.35</td>
<td>0.614( NS)</td>
</tr>
<tr>
<td>Total and differential WBC(x10^9/L)</td>
<td>10.4 ± 6.34</td>
<td>6.82± 1.79</td>
<td>0.259 NS</td>
<td>7.96± 4.47</td>
<td>7.58 ± 1.59</td>
<td>0.861 NS</td>
</tr>
<tr>
<td>Total WBC count</td>
<td>6.92 ± 1.6</td>
<td>5.82 ± 0.56</td>
<td>0.185 NS</td>
<td>6.32± 0.63</td>
<td>6.54± 1.31</td>
<td>0.744 NS</td>
</tr>
<tr>
<td>Lymphocyte</td>
<td>1.66 ± 0.42</td>
<td>2.5 ± 0.78</td>
<td>0.068 NS</td>
<td>2.04± 0.71</td>
<td>2.62 ± 1.36</td>
<td>0.424 NS</td>
</tr>
<tr>
<td>Monocyte</td>
<td>0.24 ± 0.18</td>
<td>0.2 ± 0.12</td>
<td>0.693 NS</td>
<td>0.26± 0.16</td>
<td>0.29 ± 0.11</td>
<td>1(NS)</td>
</tr>
<tr>
<td>Platelet count(x10^9/L)</td>
<td>364.6± 54.75</td>
<td>263.8 ± 62.08</td>
<td>0.026</td>
<td>347.2± 166.07</td>
<td>252.6 ± 77.6</td>
<td>0.281 (NS)</td>
</tr>
</tbody>
</table>

NS=non-significant
*p<0.05
**p<0.01
***p<0.001
****p<0.005
References


