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Studies on Clinical Parameters of Patients Suffering from Pulmonary Tuberculosis

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Pulmonary Tuberculosis (PTB) is a common disease in developing countries and efforts have been made to diagnose patients presenting complex hematological and biochemical picture. The paper presents the data on HB, ESR and RBC count of blood of patients suffering from Tuberculosis. This study was aimed at providing information on hematological changes in pulmonary tuberculosis (PTB) infection. Results showed significantly lower values of hemoglobin concentration (Hb), RBC count and erythrocyte sedimentation rate (ESR) is very high in pulmonary tuberculosis patients compared with normal.

Key words: Erythrocyte sedimentation rate, RBC count, Diseased blood, Tuberculosis.

Tuberculosis (TB), one of the oldest known diseases and still a major cause of mortality today, has many manifestations affecting the bone, the central nervous system and many other organ systems, but it is primarily a pulmonary disease. It is still a common disease in developing countries (World Health Organization 2000, Espinal, M.A., A. Laszlo et.al, 2001) and global trends in the resistance to anti tuberculosis drugs were observed (Arends, A., 1950, Bukhary, Z.A. and A.A. Alrajhi, 2007, Daves, S., J.Faujdar, P.*et al*, 2009). The comprehensive investigations on hematological changes and abnormalities associated to tuberculosis are still lacking (Cartwright, G.E., 1966, Singh, K.J., G. Ahuwalia, *et al*, 2001). Hemorheological changes in response to therapy have also not been fully determined in PTB patients living in developing countries (Awodu, O.A., I.O. Ajavi *et al*, 2007).

Hematological abnormalities have been associated with tuberculosis (Singh, K.J., G. Ahuwalia, *et al*, 2001, Awodu, O.A., I.O. Ajavi *et al*, 2007, Al-Omar, I.A. and O.A. Oluboyede, 2002). In active PTB, anemia and iron deficiency erythropoesis was observed. There was a close correlation between acid-fast bacilli in sputum and abnormal hematological values (Morris, C.D.W., 1989, Singla, R., M.M.Osman, N.Khan *et al*, 2003b). During treatment improvements in some of the hematological values such as, rise in hemoglobin and hematocrit levels (Singla, R., N. Al-Sharif *et al*, 2003a, Alrajhi, A.A. and J.A. Tawfiq, 2006).Furthermore decrease in platelet count and in white cell count and reduction in Erythrocyte Sedimentation Rate (ESR) were regarded as good indications of disease control (Morris, C.D.W., 1989). It is believed that the findings of this study may be useful as Indicators of disease progression, cardiovascular risk factors and response to therapy in pulmonary tuberculosis.

MATERIALS AND METHODS

In the present a total of 43 (all males) tuberculosis patients were included. Blood samples

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were collected from all male patients suffering from pulmonary T.B and had acid-fast bacilli in the sputum. Venous blood about 10 mL was collected from each patient where, 3 mL of the blood was transferred to Ethylene Diamine Tetra Acetic Acid (EDTA) tube, 4 mL blood was transferred to a clean screw-capped glass tube without having any anti-coagulant. The samples were put under standard laboratory temperature and processed to obtained serum by using centrifuge. By this process hematocrit of sample is maintained to be constant. However, for measuring Erythrocyte Sedimentation Rate (ESR) 3 mL of citrate solution was added. The analysis was performed in the Bio physics laboratory at S.V.Degree College, Kadapa.

EXPERIMENTAL

Erythrocyte Sedimentation Rate (ESR)

If the anticoagulated blood is allowed to stand in a tube, red cells slowly sediment to the bottom of the tube. The tube rate of sedimentation at the standard condition is termed as erythrocyte sedimentation rate. ESR is a non-specific indicator of the presence of a disease. If certain proteins cover red cells, the cells will stick to each other in column to form rouleaux and in this form RBC's sediment more than single cells.

There are two methods for the determination of ESR.

1. Westergren's method.
2. Wintrobe's method

In the present investigation Westergren's method is used to determine ESR of blood of tuberculosis patients. Westergren's method consists of a Westergren's pipette, which is a long tube graduated 300mm long with a diameter of 2.5 mm. It is marked from 0 (leaving 100 mm at the upper end) to 200 at the bottom. The tube can accommodate nearly 1ml of blood.

Estimation of Hemoglobin by Cyanmethemoglobin

Certain diseases are indicated by hemoglobin. For example, an increase in hemoglobin concentration occurs due to loss of body fluid in case of severe diarrhea and vomiting and a decrease in hemoglobin below normal range is an indication of anemia. High values are also observed in congenital heart disease, due to reduced oxygen supply in emphysema and also in polycythemia. Hemoglobin concentration drops during pregnancy due to hemodilution.

Principle

When blood is mixed with Drab kin's reagent containing potassium cyanide and potassium ferricyanide, hemoglobin reacts with ferricyanide to form methomoglobin, which is converted to stable cyanmethemoglobin (HbCN) by the cyanide. The intensity of the colour is proportional to hemoglobin concentration and it is compared with a known cyanmethemoglobin standard at 540 nm (green filter).

RBC Count

This is determination of number of red blood cells per micro liter of blood. In the present investigation electronic method is used to determine RBC count.

Electronic Method

It is based on the principle of aperture impedance method or light scattering technology or both. In this, particles passing through a chamber in single file scatter the light and convert by a detector into pulses proportionate to the size of the cells, which are then counted electronically. No lysate is used. Instead anticoagulated blood is diluted with particle free diluting fluid such as physiological saline or phosphate buffer saline. This is an easy and rapid and time saving method with high level of precision. Very large number of cells is counted rapidly.

RESULTS

Table 1 gives the data on clinical parameters of the investigation namely erythrocyte sedimentation rate (ESR), Hemoglobin content and Red blood cells count for the blood of patients, suffering from tuberculosis. It is evident from Table 1 that ESR is significantly high (20 – 150 mm in 1st hour) in case of blood of tuberculosis patients, when compared to that of normal (0 – 5 mm in 1st hour). Red blood cells count of tuberculosis patient's blood (1 – 4 millions/cu.mm) is found to be lower than that of normal (4.2 – 6.5 millions/cu.mm). The hemoglobin content is also lower (5.3 – 14.2 gm %) as compared with that of the normal (14 – 16 gm %).

The estimation of hemoglobin content and RBC count in blood is the most basic and simple procedure for the diagnosis of degree of influence of TB bacteria. In the present study, a

decrease of 38% in hemoglobin and 45% in RBC count is noticed. This may be mainly due to bone marrow suppression. Hemoglobin levels are also lowered in patients who have abnormal types of hemoglobin. Red blood cells with abnormal types of hemoglobin are often fragile, and damaged or destroyed easily in the vascular system. The condition of hemoglobin can be examined by spectroscopic method. The optical spectrum of hemoglobin of TB patients gives the qualitative information about whether hemoglobin present is truncated hemoglobin or not. Thus optical spectra provide qualitative information about the hemoglobin condition. The spectra provide qualitative information about the hemoglobin condition.

Hb Variation between Diseased and Normal Blood

Another important clinical parameter is Erythrocyte Sedimentation Rate (ESR). It is a measure of settling of red blood cells in a tube of blood during one hour. The determination of ESR has been one of the most widely used diagnostic and prognostic producers, and in spite of recent advances in diagnostic techniques, it has still great significance. The rate is an indication of inflammation and increase in many diseases. ESR is also an important index of hemorheology. ESR is increased in rheumatoid disease, tuberculosis in most inflections, and cancer. A physician can use ESR to monitor a person with associated disease. When the disease worsens, the ESR increases; when the disease improves, the ESR decreases. The ESR does not always follow the disease. ESR is called on acute-phase reactant test, measuring that it reacts to acute conditions in the body, such as infection of trauma.In the case of tuberculosis patients, the ESR of blood is significantly high, when compared to that of healthy person.

ESR Variation between Diseased and Normal Blood

The ESR of tuberculosis patients' blood can be attributed to the following factors, concerned with whole blood and its constituents - plasma and RBC.

1. Increase in the size of RBC.
2. Decrease in the hemoglobin content.
3. Low concentration of fibrinogen.
4. Aggregation or formation of RBC's.
5. Interaction between the RBC and plasma proteins.

Here, in the present investigation, the increase in size of RBC and decrease in Hemoglobin and blood viscosity may contribute significantly to raise the ESR. The study on ESR

Table 1. Data on Clinical Investigation on Blood and Erythrocytes of Tuberculosis Patients

Sample Code	E.S.R(mm) 1st hour	Hemoglobin Content (gm %)	R.B.CMillions /cu.mm
Normal	0 – 5	14 – 16	4.2 – 6.5
HB01	40	11.5	3.7
HB02	40	11.5	3.7
HB03	60	12	4
HB04	50	10.5	4
HB05	40	12	4
HB06	40	11.6	3.9
HB07	120	10.5	3.4
HB08	70	11.8	3.8
HB09	15	12	4
HB10	50	11	3.5
HB11	60	12	4
HB12	65	11.5	3.7
HB13	50	11.5	3.7
HB14	100	11	3.5
HB15	80	12	4
HB16	125	11.5	3.7
HB17	90	10.5	3.4
HB18	70	11.5	3.7
HB19	35	12	4
HB20	80	11.5	3.7
HB21	40	12	4.5
HB22	90	11	3.3
HB23	20	12	3.5
HB24	30	14.2	5.1
HB25	65	11.5	3.7
HB26	60	10	2
HB27	50	10.5	3.5
HB28	40	10.5	4
HB29	40	13	4
HB30	90	10	3
HB31	25	5.5	3
HB32	35	6.5	3
HB33	65	10	3.3
HB34	40	13	4
HB35	60	10.5	3
HB36	5	10.3	3
HB37	70	15.5	2.2
HB38	50	8.6	2.5
HB39	50	11.1	4.1
HB40	120	9.1	2.8
HB41	120	9.1	3.6
HB42	60	5.3	2.4
HB43	130	12.8	5

suggests that ESR can be used as the first step of clinical examination so as to predict the cardiovascular and pulmonary disease in advance.
1. The study reveals a decrease in hemoglobin in tuberculosis patients.
2. Erythrocyte sedimentation rate (ESR) is an important index of hemorheology. It increases significantly in the case of tuberculosis patients.
3. ESR can be used to predict the cardio vascular and pulmonary diseases in advance.

DISCUSSION

At diagnosis the mean hemoglobin concentrations were 11.46 g dL–1 for males. The value is significantly lower than the mean values for healthy male persons (Omar, M.A., V.B. Jogessar *et al*, 1983, Akintunde, E.O., W.A. Shokunbi *et al*, 1995, Hoffbrand, A.V. and J.E. Pettit, 1993) 14-16 g dL–1, respectively.

In the present study, platelet count is found higher in male PTB patients as compared with the normal values. The findings are in agreement with the earlier reports (Omar, M.A., V.B. Jogessar *et al*, 1983, Akintunde, E.O., W.A. Shokunbi *et al*, 1995) but contradictory to some of the results indicating thrombocytopenia. It was suggested that in evaluating results of hematological values in PTB, lymphopaenia rather than lymphocytosis, should be considered (Akintunde, E.O., W.A. Shokunbi *et al*, 1995).

The RBC count is lower in tuberculosis patients (3.5Millions/cu.mm) than normal (4.2-6.5Millions/cu.mm).

Erythrocyte Sedimentation Rate (ESR), in untreated male PTB patients was found to be 62.3 mm h h–1, respectively. The value is significantly higher than the standard normal values given (Hoffbrand, A.V. and J.E. Pettit, 1993). The findings are fully supported by different reports specifying higher ESR values for PTB patients (Stenius-Aarniala, B. and P. Tukiainen, 1979, Chia, Y.C. and S.J. Machin, 1979, Olaniyi, J.A. and Y.A. Aken' Ova, 2003a, Olaniyi, J.A.and Y.A. Aken' Ova, 2003b, Morris, C.D.W., 1989, Akintunde, E.O., W.A. Shokunbi *et al*, 1995).

CONCLUSION

Based on the results of the present studuy, it was concluded that all such changes were associated to metabolic disorder accompanying chronic infections in PTB patients. The varied hematological abnormalities observed in PTB patients suggested that the differential diagnosis of tuberculosis should be entertained in patients with varied hematological disorders.

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