SERUM FERROXIDASE ALBUMIN RATIO AS A MARKER IN PULMONARY TUBERCULOSIS

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ABSTRACT

Serum ferroxidase and albumin levels were determined in 98 patients of tuberculosis, of whom 49 were freshly diagnosed, sputum positive (group - I) & 49 were completely treated patients (group - II). Forty nine age and sex matched healthy individuals were taken as controls. Mean $\pm$ SD of serum ferroxidase and albumin levels in controls, group - I and group - II was found to be 864.35 ± 106.35 IU/L & 3.91 ± 0.234 g/dL, 1603.76 ± 222.65 IU/L & 3.24 ± 0.518 g/dL and 1001.78 ± 201.63 IU/L & 3.82 ± 0.43 g/dL, respectively. Serum ferroxidase in group I was significantly higher as compared to controls and group - II ($p < 0.01$). The decreased levels of serum albumin in group I, as compared to control and group - II was statistically significant ($p < 0.01$). Serum ferroxidase:albumin ratio (Ferroxidase in International Unit per gram of albumin) in group I (50.47 ± 10.36 IU/g) was significantly higher than controls (22.22 ± 3.3 IU/g), ($p < 0.001$) while in group II it was significantly lower (26.72 ± 7.18 IU/g, $p < 0.001$) than group - I and close to control values. Serum ferroxidase:albumin ratio (IU/g) can therefore be incorporated as a surrogate marker to assist in diagnosis and prognosis of pulmonary tuberculosis.

KEYWORDS

Albumin, Ferroxidase, Marker, Diagnosis, Tuberculosis.

INTRODUCTION

India has the highest number of TB cases in the world and it is second leading cause of death (1) because of its high mortality and morbidity due to the emergence of multi-drug resistant TB strains (2) and HIV infection which reactivates latent TB making it more severe. Moreover, failure to diagnose TB early remains one of the primary hurdles in curtailing the spread of this disease.

Serum ceruloplasmin is an α -2, copper transporting globulin synthesized in liver microsomes and possesses ferroxidase activity (3). It acts as an antioxidant in serum by oxidizing ferrous iron which could otherwise act as a catalyst in generating toxic free radicals (4). High serum ceruloplasmin levels were observed in patients of pulmonary TB (5). Albumin, a major plasma protein of 69 KD has been reported low in pulmonary TB (6).

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This study aims to find an application of serum ferroxidase, albumin and ferroxidase:albumin ratio in the diagnosis of pulmonary TB.

MATERIALS AND METHODS

The present study was conducted in Department of Biochemistry, Armed Forces Medical College, Pune, in collaboration with Department of Respiratory Medicine, Military Hospital (Cardio Thoracic Centre), Pune. Ninety eight cases of pulmonary TB were taken for the present study of which, 49 were freshly diagnosed, sputum positive (Group I), & 49 patients of TB who had completed their treatment and had completely recovered (Group II). Patients with any other active medical condition like pleural effusions, HIV infection, nephrotic syndrome and asthma were excluded from the study. In all cases serum ferroxidase & serum albumin levels were studied.

Forty nine age and sex matched healthy subjects without any history of pulmonary TB were also included in the study as controls.

Serum albumin was estimated by Autopak kit from Bayer, India,

on “ERBACHEM- 5” Clinical Chemistry analyzer Serum ferroxidase was estimated by a Kinetic method of Somani & Ambade (7) on Shimadzu CL-750 Spectrophotometer. Indian patent office has awarded a patent wide patent No 192356 to this method. Statistical analysis was carried out using the software program ‘Statistica’.

RESULTS AND DISCUSSION

Sputum cultures results to identify pulmonary TB are only available after 7 to 12 days in the case of a positive result, whereas a negative result is available only after 8 to 12 weeks (8). This long incubation period, makes the management of pulmonary TB difficult. Decisions made by the clinician without culture results may result in a patient receiving a delayed diagnosis or an unnecessary administration of antituberculosis drugs (8).

In spite of the recent in vitro nucleic acid direct amplification tests (DATs) (9,10), culture results still remain the “gold standard” for the presence of mycobacteria in a specimen during diagnosis and follow up (8, 11). Therefore, is a definite requirement of biochemical parameters to assist in diagnosis of pulmonary TB.

In our study, the mean $\pm$ SD of serum ferroxidase levels in controls, group I and group II, were found to be 864.35 ± 106.35 IU/L, 1603.76 ± 222.65 IU/L and 1001.78 ± 201.63 IU/L, respectively. This showed that the serum ferroxidase increases significantly ($p < 0.010$) by about 100% as compared to controls and decreases after complete treatment. This is in agreement with the studies of Shinghvi & Maitra (12), Sudha Rao (13) who reported increased levels of serum ceruloplasmin in pulmonary TB before treatment and back to normal levels after six months of treatment.

The mean $\pm$ SD of serum albumin levels in control, group I &

II was 3.91 ± 0.234 , 3.24 ± 0.518 and 3.82 ± 0.43 g/dL, respectively indicating significant ($p < 0.010$) decrease in serum albumin levels in group I as compared to controls and significant increase on treatment. This observation was in agreement with the studies of Karyadi, et.al (14); Adebisi et al (15) and Deveci (16) who reported significantly decreased serum albumin levels in newly diagnosed pulmonary TB patients. Increased serum albumin after one week of drug therapy has been reported by Vissers et al (17).

The mean $\pm$ SD of ferroxidase (IU)/Alb (g) ratio in control was 22.22 ± 3.3 while in group I & II it was found to be 50.47 ± 10.36 and 26.72 ± 7.18 , respectively. Highly significant increased ratio, more than double ($p < 0.001$) by Karlwal’s Test (ANOVA) was found in group I which on treatment was found significantly ($p < 0.001$) reverting back near to the control levels. Thus instead of ferroxidase which increases significantly in group I, if the ferroxidase albumin ratio is used by measuring decreased albumin to assist in the diagnosis and therapy of pulmonary TB, then statistically more significant changes are observed.

Estimation of ferroxidase by the method developed by Somani and Ambade (7) which requires 50 μ L of serum, and can be completed in 90 seconds and method is cost effective. Estimation of albumin by BCG dye binding which requires 10 μ L of serum and is completed within 120 sec can be feasibly incorporated as a surrogate marker to assist in the diagnosis of pulmonary TB. Its role in the prognosis of pulmonary tuberculosis could be assessed with follow up studies.

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Table I : Values of ferroxidase (FOD), albumin (Alb) and ferroxidase/albumin ratio in controls, group I and II

Subjects	Ferroxidase (IU/L)	Albumin (g/dL)	FOD/Alb (IU)/(g)
Controls	864.4 ± 106.4 (557 - 1057)	3.91 ± 0.23 (3.0 - 4.5)	22.22 ± 3.3 (13 - 31)
Group I	1603.8 ± 222.7 (1114 - 2000)	3.24 ± 0.52 (2.4 - 4.5)	50.47 ± 10.36 (38 - 83)
Group II	1001.8 ± 201.6 (597 - 1600)	3.82 ± 0.43 (2.9 - 4.5)	26.72 ± 7.18 (15 - 53)

Values are mean $\pm$ SD; Values in paranthesis indicate range

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